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(71) Applicant *(for all designated States except US)*: VERIFONE, INC. [US/US]; Three Lagoon Drive, Suite 400, Redwood City, CA 94065 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)* : SMITH, Gerald, W. [US/US]; 484 Cordoba Lane, Vacaville, CA 95688 (US). TRAN, Dich, C. [CH/US]; 18495 Chelmsford Drive, Cupertino, CA 95014 (US).

(74) Agents: SHERIDAN, James, A. et al.; Flehr, Hohbach, Test, Albritton & Herbert, 4 Embarcadero Center, Suite 3400, San Francisco, CA 94111-4187 (US).

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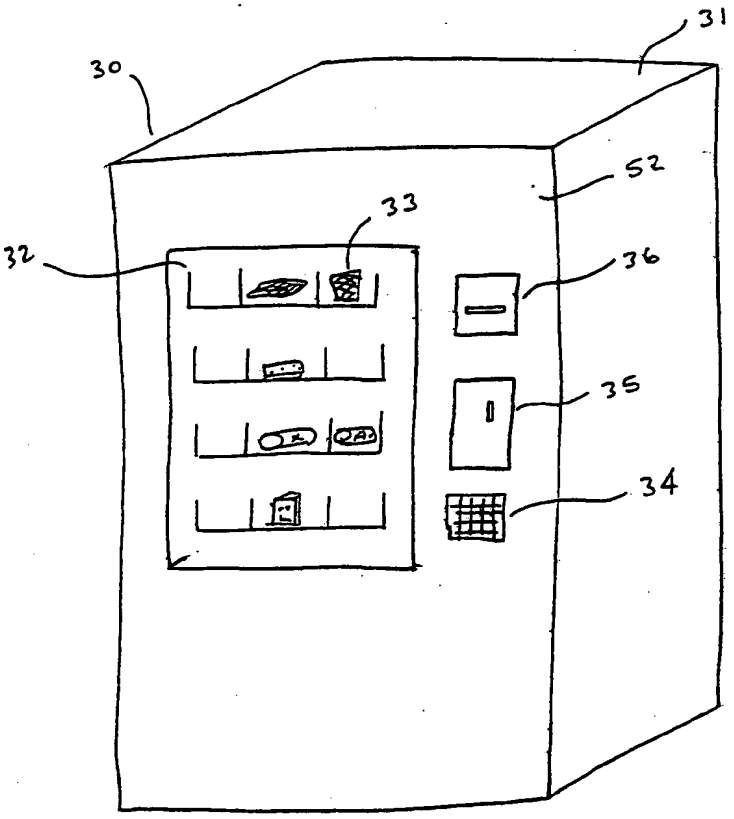
(54) Title: DISPENSING MACHINE WITH DATA CARD SCANNER APPARATUS AND ENHANCED FEATURES

(57) Abstract

A dispensing machine payment acceptance apparatus for dispensing products or services from a dispensing machine (30) upon user request and payment is disclosed. The apparatus comprises a data card scanner apparatus (36) for acquiring payment and other information. It also comprises an electrical signals interface (39) between the scanner and the dispensing machine to indicate proper payment has been made. Cash payment, such as coins and paper bills, may also be accepted and apparatus (35) is disclosed in the dispensing maching payment acceptance apparatus for generating electrical signals indicative of an amount of cash accepted. The invention discloses a card swallowing feature which enables the scanner to retain the card when the data card is defective or has other predetermined characteristics. In some embodiments the scanner has a geometrical form factor substantially similar to a standard bill validator apparatus.



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DISPENSING MACHINE WITH DATA CARD SCANNER APPARATUS AND ENHANCED FEATURES

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to the field of unattended machines for dispensing or vending products and services and more specifically relates to the field of dispensing machines that permit access using a plurality of payment means including data cards.

Description of the Related Art

Machines for the unattended vending or dispensing of products are commonplace. In the past, the types of items dispensed were generally limited to relatively inexpensive items such as for example candy, cigarettes, and soft drinks. The type of items dispensed and the relatively larger value of a dollar in the past, compared to its value today, meant that vended purchases could generally be made with a few coins.

The expansion of the vending machine sales methodology to more sophisticated and higher priced items, coupled with general economic inflation has resulted in many items whose purchase price exceeds the average consumer's pocket or purse change. Consumers with sufficient cash, but in paper bills rather than coins, were turned away from such machines in frustration. On occasion, change could be obtained from another person or merchant, but asking for change may be

somewhat demeaning, and providing change was often a nuisance to the provider, particularly if provided by a competing merchant in the vicinity. The vending machine owner or operator also suffered due to lost sales.

An limited solution was provided by the introduction of a bill changer in proximity to the coin operated vending machine. A bill changer is generally a stand-alone machine which provisionally accepts paper currency, generally of a fixed denomination, performs some validation to assure its authenticity, and then presents an equivalent amount of change for the customer which could subsequently be used in the coin operated machines. This permitted continued use of the coin operated machines at only moderate consumer inconvenience. However, provision of bill validators may have been economically practical only if several vending machines were collocated and shared a single bill changer. The cost of the bill changer and the requirement to fill the bill validator with coins, essentially a non-interest bearing remote bank account, making the provision of stand-alone bill changers for each vending machine somewhat prohibitive. Security is also a concern, since the unattended cash is attractive to potential thieves.

As new vending machines have been produced, the ones capable of vending higher priced items may incorporate a bill validator as a standard module, or be designed to be retrofitted with one. The provision of a integral bill validator in addition to the traditional coin operation fulfills some of the consumer's needs but leaves other problems unsolved.

The bill validators initially installed either integrally or as stand-alone units were typically configured to accept U.S. one-dollar notes. In some markets, higher valuation bills, such as U.S. five-dollar notes may be accepted but these are unusual rather than commonplace features.

As a result, consumers having sufficient cash may still be frustrated by not having cash in the proper form for the machine to accept, in this case coins or one-dollar bills. The consumer may actually be in a more difficult position when attempting to get change, from for example a 20-dollar bill, because of the greater amount of money involved. The provision of coin acceptors or fixed-denomination bill changers has not kept up with the higher valuation of products and the effects of inflation. The vending machine owner still looses profit because of lost sales.

The rationale for limiting the denomination of paper currency accepted is somewhat persuasive from the standpoint of the vending machine owner or operator. Security and loss of potential investment interest are the primary additional concerns. The acceptance of larger denomination bills necessarily requires larger amounts of change internal to the machine. This constitutes a greater initial monetary investment to fund operation, results in loss of interest income which could be gained on the same funds if deposited into an interest bearing account, and presents a greater threat from theft because of the larger amounts of cash involved. The potential loss by the use of counterfeit currency is also greater since larger amounts of genuine coins could be extracted more quickly with larger counterfeit notes.

Operation of machines that accept multiple denomination paper currency, such as one-dollar, five-dollar, ten-dollar, and twenty-dollar notes, present additional problems. Such a bill validator may require substantial additional technological sophistication to discriminate among the accepted paper currency denominations and to detect counterfeit currency. It is economically difficult to justify placing this high level of complexity in the large number of machines needed to satisfy consumer demand.

These problems affect both the potential purchaser of products from the dispensing machines and the owner or operator of the vending machine. There are other longer term affects on the vending machine marketing concept which results from continued use of machines which accept only coins or currency.

Consumers are becoming more comfortable in performing relatively large financial transactions through the use of a card of some type and possibly a personal identification number (PIN). Such access is becoming common for unattended access to bank teller machines, public transportation systems, and the unassisted purchase of airline travel tickets for example. There are many other examples.

Given this trend, consumers are more comfortable making unattended purchases involving larger monetary amounts with non-currency devices. The faster paced lifestyle also encourages purchases, or rentals, from unattended machines which offer the potential of 24-hour access. The requirement for cash stalls this potential growth area and is an inconvenience to customers.

It is also advantageous to the vending machine owner or operator to have a machine capable of cash free operation. Cash free operation, especially if the cash free operation is recognized by the potential thief, eliminates the problems associated with theft and theft based vandalism. It also eliminates the need for loss of interest on a possibly substantial cash fund within the machine.

For a part of the consuming public bank credit cards could provide the flexibility needed to access the more sophisticated dispensing machines that are being introduced today. However, their are serious problems with reliance on these existing credit or debit methods.

One immediate problem from the standpoint of a vending machine owner is the potentially very high per purchase transaction charge levied by the banks on their bank credit cards for such transactions. These transaction charges may be acceptable for the larger purchases but may be unacceptable from a merchants or consumers point of view for individual item transactions of a few dollars or less. This type of access would not be suitable for all types of purchases.

A second problem associated with the reliance on bank credit cards is the fact that not all segments of the public qualify for credit cards, minors in particular constitute a significant segment of the vending market who would not have credit cards. Other market segments do not generally, or perhaps at the time the purchase is desired, have an appropriate credit balance to allow the transaction to go through.

There is also necessity of some communication link with the bank or other administrative organization for approval. Even if such a communication link is provided, the processing delay may be unacceptable during peak purchasing periods and would discourage use.

Other persons may be hesitant to use their credit card for minor transactions. A further potential problem relates to personal privacy in an age of data bases which track an individuals every move and purchase. There are individuals who prefer to operate on a financial basis that approaches the anonymity associated with cash. Bank credit cards do not permit such anonymity.

Other individuals may hesitate to deposit their bank credit card in an unattended location, where mechanical or electrical failure could preclude card recovery and force a customer to abandon their credit card. This same concern is not present at such machines as bank teller machines due to

the perception of greater reliability of these machines, or alternately that in the event of some failure, the card will be kept by the financial institution and will not fall into unauthorized hands, thereby subjecting the card owner to relatively unlimited financial liability.

Beyond the actual problems associated with the aforementioned cash or credit card transactions, there are other limitations associated with these access techniques. The promotional use of discount coupons has long been employed to facilitate sales of new products, for example. There is no known existing equivalent method of promoting a first purchase of a new item from a vending machine by a particular market segment. The price of a vended items may be attractively reduced, but this may result in loss of profits from persons making multiple purchases of that item at the reduced, perhaps unprofitable price. Alternatively, the general public rather than a specific market segment may be induced to buy, again diminishing profits.

It is also highly desirable that if some type of debit card implementation is used, then the cards should be transportable and capable of use in a variety of similar machines. This gives the consumer confidence that his investment will not be wasted if he does not return to the data card issuing location.

Another problem associated with expanding the nature and scope of vending machine access instruments is the large inventory of existing vending machines which owners would prefer to operate for the remainder of their useful life. Therefore there is a desirability of retrofitting any improvement to these devices within the existing vending machine structure.

Supplementary devices which attach to the machine externally, either by direct attachment or by a separate stand-alone unit are problematic in that they either consume

additional floor space which may not be available, create a safety problem by extending from the front of a vending machine into the room, or result in inefficient space utilization and potential loss of sales if they are mounted to the side of an existing vending machine. In the later case, vending machines in a multi-vending machine installation (such as a solid wall of adjacent machines) will have to be spaced at greater distance intervals, and where there is insufficient free space to extend the line of machines, some vending machines may have to be eliminated with consequential loss of product sales, which may not be made up by the sales of available items.

There have been attempts to satisfy the need and solve the aforementioned problems, but these prior attempts have not been successful.

Capers et al. (U.S. Patent 4,669,596) describe an accessory to a cash operated vending machine which purports to permit operation by either money or coded card. However, it is externally mounted and does not provide the advanced features desirable in today's sophisticated consumer market. For example, the Capers et al. apparatus does not provide a data card retention feature, nor capabilities for promotional marketing. The Capers et al. apparatus also requires the conventional retention of a means for handling money and producing an electrical output signal in response to received money which precludes a simplified all debit card type of operation. This precludes a completely cash free operation, or requires the retention of unused internal cash handing equipment. The Capers et al. apparatus also requires structural modification to the vending machine for mounting the accessory.

An apparatus by Stutsman (U.S. Patent 4,884,212) was also an attempt to satisfy the need and eliminate some of the aforementioned problems. However, it too failed to completely satisfy the need. The Stutsman apparatus was

largely a self contained unit which stored most of its information in internal memory and only a minimum amount of data on the data card. Also, the Stutsman apparatus relies on a either an internal or a remote database to retain customer data. The information is not contained on the card, other than an identification code, and is not updated as transactions are made. The cards are prevalued and a card with the appropriate value is dispensed when payment is made; information is not written to the card at the vending location by the machine dispensing the card. Therefore it lacks the desired transportability. The Stutsman apparatus is an entire system and is not suitable for installation in existing machines lacking data card access means. The Stutsman apparatus also does not provide the advanced features desirable in today's sophisticated consumer market. For example, as with the Capers et al. apparatus, it does not provide a data card retention feature, nor capabilities for promotional marketing.

Thus, there has been a need for a method and apparatus for accessing unattended machines which dispense a range of products or services and which overcomes these problems and limitations. The present invention meets this need.

In response to this need it is an object of the present invention to provide a vending machine access method which can reduce or completely eliminate the need for cash money transactions.

Another object of the present invention is to provide a vending machine access method which can be added to existing vending machines without mechanical modifications and without changing or replacing the existing electrical components or wiring.

Another object of the present invention is to provide a vending machine which provides for non-cash access coupled with anonymity of personal actions.

Another object of the present invention is to provide a vending machine access method which is readily transportable from machine to machine.

Another object of the present invention is to provide a non-cash vending machine that does not require connection or access to an external database.

Another object of the present invention is to provide a vending machine that has a card retention capability for defective cards.

Another object of the present invention is to provide a vending machine that has enhanced security features.

Another object of the present invention is to provide a vending machine that provides for promotional marketing of selected products to selected market segments.

SUMMARY OF THE INVENTION

A dispensing machine payment acceptance apparatus for dispensing products or services from a dispensing machine upon user request and payment. The apparatus comprises a means for scanning a data card and acquiring payment information in the form of electrical signals. It also comprises means for interfacing the electrical signals with the dispensing machine to indicate proper payment has been made. Means for accepting cash payment and generating electrical signals indicative of an amount of cash accepted may also be provided in the dispensing machine payment acceptance apparatus, including coin acceptors and bill acceptors. Means for retaining or swallowing the data card when the data card is defective or has other predetermined characteristics may also be provided. In some embodiments the means for scanning a data card has a geometrical form factor substantially similar to a standard bill validator apparatus.

BRIEF DESCRIPTION OF THE DRAWINGS

The purpose and advantages of the present invention will be apparent to those skilled in the art from the following detailed description in conjunction with the drawings.

FIG 1 is an illustrative drawing which shows an embodiment of a dispensing machine;

FIG 2 is an illustrative drawing which shows a block diagram of an embodiment of a dispensing machine according to this invention as illustrated in FIG 1;

FIG 3 is an illustration which shows a block diagram of a configuration of elements in a conventional dispensing machine;

FIG 4 is an illustration that shows a dispensing machine similar to that shown in FIG 2 with an additional element;

FIG 5 is an illustration which shows a block diagram of the configuration of the elements of the embodiment illustrated in FIG 4;

FIG 6 is an illustration which shows an embodiment of the invention which includes neither a coin acceptor nor a bill validator;

FIG 7 is an illustration which shows the connectivity of the elements of the embodiment of the invention shown in FIG 6;

FIG 8 is an illustration which shows a standard template and associated hardware for coupling to a bill validator on a dispensing machine front panel;

FIG 9 is an illustration that shows the timing diagram for Coin and Non-Coin messages;

FIG 10 is an illustration that shows the timing diagram for Tube Status messages;

FIG 11 is an illustration that shows the format of the coin message of the TRC-6000 standard interface;

FIG 12 is an illustration which shows the format of the Tube Status message of the TRC-6000 interface;

FIG 13 is an illustration which shows the nominal TRC-6000 interface circuitry associated with the input circuit;

FIG 14 is an illustrations which shows the timing associated with several signals;

FIG 15 is an illustration which shows the nominal TRC-6000 interface circuitry associated with the output circuit;

FIG 16 is an illustrations which shows the timing associated with several signals;

FIG 17 is an illustration which shows a block diagram of the connectivity between the elements of a conventional single-price, four-price, ten-price and multi-price vending machine which incorporates both a bill acceptor and a coin acceptor;

FIG 18 is an illustration which shows an 8-pin coin mechanism plug which is used to connect the coin mechanism to the dispense portion of the vending machine for a single-price machine;

FIG 19 is an illustration which shows the coin mechanism/vending machine interface for a single-price escrow to vend type machine;

FIG 20 is an illustration which shows the coin mechanism/vending machine interface for a single-price full escrow to select type machine;

FIG 21 is an illustration which shows an 8-pin coin mechanism plug which is used to connect the coin mechanism to the dispense portion of the vending machine for a four-price machine;

FIG 22 is an illustration which shows the coin mechanism portion of the coin changer/vending machine interface for one type of four price vending machine;

FIG 23 is an illustration which shows the vending machine side of the coin changer/vending machine interface for one type of four-price vending machine;

FIG 24 is an illustration which shows an 18-pin coin mechanism plug which is used to connect the coin mechanism to the dispense portion of the vending machine for a ten-price machine;

FIG 25 is an illustration which shows the coin mechanism portion of the coin changer/vending machine interface for a ten-price vending machine;

FIG 26 is an illustration which shows a 18-pin coin mechanism plug which is used to connect the coin mechanism to the dispense portion of the vending machine for a multi-price machine;

FIG 27 is an illustration which shows the coin changer/vending machine interface for a multi-price vending machine;

FIG 28 is an illustration which shows a block diagram of the major components of a conventional MicroMech based vending machine, or other vending machine having a separate vending machine controller board;

FIG 29 is an illustration which shows the 12-connector coin mechanism plug for a MicroMech interface;

FIG 30 is an illustration which shows a MicroMech Coin Changer to vending machine interface;

FIG 31 is an illustration which shows an embodiment of a data card scanning apparatus suitable for use in the present invention;

FIG 32 is an illustration which shows a block diagram of the elements and connections between elements of a vending machine system according to this inventions, which does not utilize a separate vending machine controller;

FIG 33 is an illustration which shows a block diagram of the elements and connections between elements of a vending machine system according to this inventions, which utilizes a separate vending machine controller;

FIG 34 is an illustration which shows an interconnection diagram of an embodiment of a Scanner Apparatus Controller PCB for a data card scanner interface which supplies the signals necessary for either single-price vending machine applications or a multi-price vending machine applications;

FIG 35 is an illustration which shows how the scanner interface may be interposed between a coin acceptor and a vending machine controller board for a MicroMech type vending machine;

FIG 36 is an illustration which shows an interface for a single-price vending machine application;

FIG 37 is an illustration which shows an embodiment of a scanner interface for a four-price vending machine application;

FIG 38 is an illustration which shows an embodiment the modular data card scanner and the attached power supply and interface unit;

FIG 39 is an illustration which shows an exploded view of a standard template for the dispensing machine front panel cutout, its mounting hole pattern, and its relationship to an embodiment of a data card scanner.

The purpose, structure and advantages of the current invention will be apparent to those skilled in the art from the following detailed description of a particular embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The following description is presented to enable any person skilled in the art to make and use the invention, and is provided in the context of a particular application and its requirements. Various modifications to the preferred embodiment will be readily apparent to those skilled in the art, and the generic principles defined herein may be applied to other embodiments and applications without departing from the spirit and scope of the invention. Thus, the present invention is not intended to be limited to the embodiment shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.

The present invention concerns a machine for dispensing products or services which has advanced features. The products or services may be accessed by a consumer who presents payment in a variety of forms, including a data card. The data card incorporates some means for storing information. The information storage and retrieval may

conventionally be accomplished using magnetic recording techniques but the data card may incorporate any of various other types of information storage and retrieval technologies, including data cards commonly referred to a "smart cards."

For example, a data card may store information using magnetic recording techniques to read from or write to surface or subsurface regions of the data card. Alternatively the data card may contain electrical circuits, such as an integrated circuit imbedded in a plastic or other substrate and having the ability to be read and/or written to and communicating by either electrical contacts or by a contactless system. Such contactless systems may include magnetic, radio-frequency (RF), capacitive, or optical interface methods, for example. Other data card alternatives include data cards using optical data storage and retrieval methods, such as changes in light transmission or reflectivity at some optical wavelength range, including visible and infra-red wavelengths. Data cards may also by of hybrid design and incorporate more than one information storage, processing, and interface technology. In particular, such data cards may contain electrical circuits and information processing software and/or firmware in addition to magnetic, electronic, optical, or other sensor or recording technology. Each type of card has at least one data read/write interface region. Communication between the data card and the scanner apparatus occurs at the data read/write interface region, the structure of which region varies with the type of data card. For magnetic data stripe cards the data read/write interface region may comprise the magnetic data stripe itself, for example. For data cards having internal electronic circuitry, the data read/write interface may comprise one or more electrical contacts, or a contactless system, for communicating between the internal circuits and the scanner apparatus, for example.

This information is advantageously used by the dispensing machine and allied equipment to provide advanced vending, convenience, and security features. These advanced features may include, but are not limited to, the ability to set or restrict the maximum monetary value to the card, facilitation of promotional sales, the ability to retain possession of a data card under predetermined conditions and other enhanced security features. The present invention also advantageously provides a modular data card scanner for scanning a data card and associated electronic interface which is capable of very simple retrofit installation into existing dispensing machines which have a standard bill validator configuration or were designed to accept a standard bill validator at a later time. The invention may be installed without structural modifications to the dispensing machine if a standard bill validator has been installed previously. If a dispensing machine has been designed to accept the standard bill validator unit, then the data card scanner may be installed in its place either during initial manufacture or during a retrofit operation. The form of the data card scanner and the method of scanning, reading information from the card or writing information to the card, may depend on the type of technology employed by the data card for storage, retrieval, and communication. So called "universal scanners" may incorporate several scanning technologies within a scanning unit and thereby provide the functionality necessary to operate with any type of data card.

A vending machine has traditionally been associated with the unattended sale of inexpensive to modestly priced consumer products; snack foods and refreshments being common examples. The scope of machine vended products has expanded in recent years to encompass more expensive or more sophisticated consumer products than were traditionally available. However, the concept of a vending machine need not be limited to tangible products. Services may also be included within the context of machine vended items. One

very traditional example of a pseudo-vending machine which provides services is the pay telephone. More recent examples of vended services are, for example, video games at video game parlors, and access to public transportation systems.

Many sales handled by a human cashier are amenable to vending machine concepts if the provided product or service can be sufficiently identified by machine without cashier, or equivalent human, interaction. Such payment means may substantially reduce payment queues in some instances. Other examples include restaurant meal counter payment and the unattended purchase of event tickets, for example.

In the context of the present invention, the terms vending machine or dispensing machine are intended to equivalently mean any unattended point of sale of product and/or service, and are not intended to be restricted to traditional vending machine concepts. In this regard, the term dispensing machine is used in preference to the term vending machine to encompass the anticipated broader scope of unattended sales that may result from technological advances, including this invention.

FIG 1 is an illustrative drawing which shows an embodiment of a dispensing machine. This embodiment of a dispensing machine 30 comprises a machine housing 31, a product or service display area 32, including a plurality of product 33, a means for selecting product 34, a means for accepting coins 35, and a means for scanning a data card 36. The dispensing machine also comprises means for dispensing product, means for controlling dispensing, and means for interfacing which are generally internal to the dispensing machine housing 31 and are not shown in FIG 1.

Means for selecting product 34 is conventionally some type of product selection apparatus 34 which the customer interacts with. Common examples are individual push buttons

for each product, an alpha numeric keypad which associates an alphanumeric code with a product location, or some similar type of push button or touch-pad input device.

Means for accepting coins 35 is conventionally a coin acceptor device of which there are many types. An example of a common coin changer apparatus is the MC5 Coin Changer manufactured by Mars Electronics. The means for accepting coins such as a coin changer or the means for accepting bills (described below) provide a means for accepting cash payment. Both the coin acceptor and bill validator generate electrical signals indicative of the amount of cash accepted.

Means for dispensing product 37 is conventionally an electro-mechanical product dispensing apparatus which comprise devices such as motors, solenoids, or other mechanical actuators which respond to electronic signals. These product dispensing apparatus generally either move a product or allows a product to move from a storage location internal to the dispensing machine and present it to the customer. The electro-mechanical devices generally receive activating signals from the means for controlling dispensing 38. A common example of product dispensing apparatus are spiral lead screw type devices which rotate a certain number of turns under the control of an electric motor and move a product a linear distance to the end of a shelf associated with the lead screw, at which point the product is free to fall off of a storage shelf into a bin accessible to the customer. Another common example of such a product dispensing apparatus is a slidable or hinged access door wherein access is controlled by a solenoid type lock. Another example is a dispensing machine wherein product is stacked, such a beverage cans, and an electrical signal allows one item to fall into an access bin where it may be retrieved by a customer.

Means for controlling dispensing 38 is conventionally a dispensing controller which may be implemented by simple switches and electromagnetic relays. These switches and relays may receive activating signals or activating power after a product has been selected and sufficient payment has been received and supply the product dispensing apparatus 38 with activating power to actually dispense the product. The signals received by the dispensing controller 38 may be supplied directly by a coin changer 35 in some applications, by means for data card scanning 36, or from a means for interfacing 39 in a more sophisticated vending machine applications. The actual circuitry required by this dispensing controller is dependent on the application and may be as simple as electrical wires which conduct power to a motor or solenoid after an electronic switch or electromagnetic relay has opened or closed.

Means for scanning a data card 36 is conventionally a data card scanner apparatus and any required electronic interfaces, including firmware and software that may be required. The data card scanner apparatus 36 may generally be one of a number of types currently available on the commercial market or known in the art, although not all will provide the same level of performance or enhanced features. Essential characteristics include transducers for detecting the data stored on the data card, at least one transducer for writing data to the data card, and an assembly for either scanning the card past the transducer, scanning the transducers past the card, or for transporting the card to, or from, a transducer read/write station to accomplish the read and write functions. The transducers may be of any type such that the stored information may be read and converted to a form useful to the scanner and/or vending system, typically in the form of electrical signals; or converted from the electrical signal of the vending machine or scanner into electronic, magnetic, optical, or other form when written to the data card. The transducers are conventionally of the type that transform electrical signals to

magnetic fields or magnetic fields to electrical signals. Linear motion reader/writer mechanisms having fixed transducers are disclosed in patents by Pass, U.S. Patent 3,386,753; Pfost et al., U.S. Patent 4,020,325; and Redemacher, U.S. Patent 4,879,607, which are hereby incorporated by reference. A rotary reader/writer mechanism is disclosed in U.S. Patent Application Number 07/679,944, filed May 9, 1991, also incorporated herein by reference. Each of the foregoing exemplary reader/writer mechanisms are appropriate for specific application where a variety of card thicknesses will not be encountered. However, to provide a more versatile system, the reader/writer mechanism should communicate with cards of a variety of thicknesses such that reconfiguration is not necessary to conform to a customer's needs. Therefore, a data card such as that which is disclosed in U.S. Patent Application Serial No. 07/775,738, filed October 11, 1991, assigned to the assignee hereof, which is incorporated by reference, is preferred. Other advantages of this scanner are that it uses advanced security measures to thwart fraud, it maintains the card within the system during the revolve process, and it is compact. This linear scanner also provides a card swallow feature which swallows the data card upon the determination of invalidity, damage, or excessive wear.

Means for interfacing 39 is conventionally an electrical interface which receives electrical signals from an apparatus such as a coin changer 35 or data card scanner 36, and processes the signals in an appropriate manner so as to present them to the vending machine dispensing circuitry, generally the dispensing controller 38, in a format that can be understood and used by the dispensing controller 38 to carry out the intended functions, such as dispensing a particular product. Common examples of interfaces are electrical wires, optical communications links, interfaces that provide electrical buffering and amplification, and interfaces that perform logical operations on the received signals. Specific examples of interfaces used for

particular embodiments of the present invention are described subsequently.

FIG 2 is an illustrative drawing which shows a block diagram of the major vending machine elements and their relationship in an embodiment of a dispensing machine according to this invention as illustrated in FIG 1. It diagrammatically illustrates a product selection apparatus 34, a coin acceptor 35, a data card scanner 36, a product dispensing apparatus 37, dispensing controller 38, and a scanner interface 39 and the connectivity between them.

FIG 3 diagrammatically illustrates a conventional configuration of major vending machine elements. The elements and their connectivity differs from the elements and connectivity in the embodiment of the invention illustrated in FIG 2. In FIG 3 there is shown a product selection apparatus 34, a coin acceptor 35, a product dispensing apparatus 37, and dispensing controller 38. In the embodiment of the invention illustrated in FIG 1 and FIG 2, the scanner interface 39 is interposed between a coin acceptor 35 and a dispensing controller 38 of the conventional configuration thereby replacing the direct connection between these elements in the conventional configuration.

Inclusion of a coin acceptor 35, a bill validator 41, and a data card scanner 36 including scanner interface 39 provides a very flexible multi-payment accepting dispensing machine.

FIG 4 is an illustrative drawing which shows a dispensing machine similar to that shown in FIG 2 except for the addition of means for accepting a bill 41. Means for accepting a bill 41 is conventionally a bill validator, or bill acceptor apparatus. One dominant bill validator model is manufactured by Rowe International, Incorporated of Grand

Rapids, Michigan 49507. The Rowe Model CBA-4 is generally characteristic of the standard size, electrical interface characteristics, and mechanical mounting method for dispensing machine bill validators 41.

The inclusion of a bill validator 41 somewhat changes the configuration of the elements but the operational principles remain substantially the same.

FIG 5 is an illustration which shows a block diagram of the configuration of the elements of the embodiment illustrated in FIG 4. The bill validator 41 is connected to dispensing controller 38. The other elements and their configuration may be substantially the same as in the embodiment of FIG 2. It is also possible for the bill validator 41 to be connected to or through the coin acceptor 35 instead of directly to the dispensing controller 38.

The dispensing machine elements and their connectivity are illustrative of a possible method of connection. Other elements may be added, and the connectivity altered without departing from the scope of the invention. Some elements may also be removed without making the system inoperable. For example, the bill validator 41 and/or the coin acceptor 35 may be eliminated from the dispensing machine system without effecting the operability of the vending machine through the data card scanner 36. Such operation may be desirable if a cash free installation is desired or represent an operable resulting configuration in the event of a failure of either the bill validator 41 or coin acceptor 35. FIG 6 is an illustration which shows an embodiment of the invention which includes neither a coin acceptor 35 nor a bill validator 41. The connectivity of the elements is illustrated in FIG 7. A detailed description of the several elements and their connections as incorporated into an embodiment of the invention will be described subsequently.

The individual elements identified in FIGS 1 through 7 are described so that their function in the invention and their interrelationship is made clear so that a subsequent detailed discussion of the embodiments of the invention may be more easily understood.

A coin acceptor 35 may be incorporated into the dispensing machine embodiments of the present invention to process coins presented to the dispensing machine by a customer. This function has conventionally been accomplished by an apparatus variously termed a coin acceptor, a coin machine, or coin changer; but the invention is not limited to these conventional coin acceptor apparatus. No particular distinction between a coin acceptor, coin machine, or coin changer is intended by the use of a particular term; they are equivalent in most contexts. An example of a commercial coin changer 35 is the MC5 line of coin changers manufactured by Mars Electronics.

In a conventional vending machine, a coin acceptor 35 is an apparatus which is capable of receiving coins, or coin like tokens, from a dispensing machine customer; processing the coin inputs so as to determine the validity and value of the coins and a total monetary deposit; providing information relating to the coins received to the product or service access mechanism of the machine; and when a sufficient deposit has been made to signal a product dispensing portion of the machine to actuate the service or dispense the product; providing change to the vending machine user, based on its own determination of the change due or based on information from another source such as a vending machine controller.

Inclusion of a coin acceptor 35 as an element of the embodiments of the invention may be advantageous although it is not required in all embodiments of the invention. One advantage is that in spite of higher priced and more sophisticated product offerings, dispensing machines

generally continue to offer some products which may reasonably be purchased by pocket change. A second advantage is the ability of an embodiment of the invention to take advantage of the presence of an existing coin acceptor 35 interface so as to reduce any modifications that may be necessary to incorporate a data card scanner 36 in a dispensing machine.

It should be noted, that the coin acceptor 35 itself need not be present for the operation of some embodiments of the invention. It is only necessary that the vending machine support the coin acceptor interface 39 so as to be compatible with the data card scanner 36 interface. In particular, it may be desirable to maintain a cash free vending machine operation by eliminating the coin acceptor 35 and the bill validator 41. The use of the coin acceptor 35 in the overall dispensing machine system concept will be described in detail with regard to the element interfaces.

The embodiment of the present invention illustrated in FIGS 4 and 5 comprises a means for accepting bills 41. Such a means for accepting bills 41 may be implemented with a conventional apparatus generally referred to as a bill acceptor, bill changer, or bill validator. This description adopts the language bill validator 41 because this terminology is generally applied by workers in the field. No distinction between bill changer, bill acceptor, bill validator, or similar terms such as currency changer, is intended. The invention need not incorporate a bill validator 41, and where cash free operation is desired, a bill validator 41 need not be provided. It also need not be provided where it is more desirable to configure a data card scanner 36 than a bill validator 41, and where space is limited to provision of one or the other. Where a bill validator 41 is present, the invention encompasses the use of means for accepting bills 41 other than the conventional

bill validator 41 so long as the other requirements described herein are satisfied.

A conventional bill validator 41 generally comprises a device which transports an item of paper currency presented at the outside of the device at a bill receiving aperture 42, into the interior of the device for validation. Once the item is validated as being authentic and of proper value, it is retained by the device and either a monetary credit of equivalent value is reserved in some memory storage usable for a subsequent purchase, or when integrated with a coin dispenser apparatus, may provide coins to the customer in an amount equal to the value of the paper currency. Other embodiments of a bill validator 41 are applicable to the present invention.

The vending machine industry has attempted to standardize many attributes of the vending machine apparatus. Most conventional bill validator 41 units adopt industry standard characteristics, including dimensions and electrical interfaces which permits substitution of different bill validator 41 models, either made by the same or different manufacturers, into a dispensing machine.

While the internal structure of the bill validator 41 may generally differ among models or manufacturers, they generally have similar external and electrical characteristics so that substitution between models is possible. Mechanically, they are generally made to be mounted to a front panel 52 of a dispensing machine 30 with all or a substantial portion of the bill validator 41 unit projecting into the interior of the dispensing machine. One of the ends of the bill validator 41 projects through a hole in a front panel 52 in the dispensing machine 30 where a customer may access it by presenting currency bills to a bill receiving aperture 42 for validation and acceptance.

Mechanical and electrical standardization is beneficial because the unused space in the interior of a dispensing machine may be somewhat limited. A standard template 51 for the dispensing machine front panel 52 cutout and mounting hole 53 pattern is illustrated in FIG 7. FIG 7 also illustrates the standard mounting bezel 54 which comprises integral threaded fasteners 55 for coupling to a bill validator 41 on a interior side 59 of the dispensing machine front panel 52 directly or with additional mating couplers (not shown).

Conventional vending machines have some means to control the dispensing of a product 38. In the simple machines, such as a machine dispensing a single priced product, the dispensing controller 38 may be simple switches and relays. In more complex vending machines such as a machine vending a variety of different priced products, a more complex dispensing controller 38 may be present. A dispensing controller 38 coordinates the actions of the various elements of the dispensing machine possibly including the actions of a coin acceptor 35 and a product dispenser apparatus 37.

The invention is compatible with vending machines having different dispensing controller 38. Different machines may require different scanner interfaces 39 and firmware and/or software changes in the data card scanner 36. Some of the embodiments of the present invention comprise a dispensing controller 38 which are responsive to data structures and control signals selected from a group of standard interface protocols such as MicroMech, MC5000, TRC6000, MC5, or variants thereof. There is also a comparable standard for debit card devices. Some of these standards are promulgated by the National Automatic Merchandising Association (NAMA). The coin acceptor 35, bill validator 41, data card scanner 36, and a scanner interface 39, are better described after reference to a description of standard interface specifications.

Other embodiments of the invention are compatible through the use of different data card scanner interfaces 39, firmware, and software adapted for the signal requirements of single-price, four-price, and ten-price machines. The single-, four-, and ten-price machines do not utilize a separate vending machine controller, nor do they utilize the MC5, MC5000, TRC-6000, or MicroMech standard signals. However, the signals required for operation of these machines is relatively simple and are readily generated by the data card scanner controller or controller and scanner interface.

The characteristics of the TRC-6000 Interface Standard is described below. It is a revision of the MC5, MC5000, or MicroMech interface specification. The contents of the MC5000, TRC-6000, MC5, and MicroMech standard specifications, which are equivalent in their essential features, are incorporated by reference into this application. The description which follows describes the main features of these standards, as a guide to understanding the operation of the interface between the data card scanner 36 and the vending machine elements, particularly the vending machine controller.

The preface to the MicroMech Interface Standard indicates that the specification is an attempt to clarify the use of the MicroMech interface as first implemented in the MC5 family of coin acceptors. The specification also covers the TRC-6000 line of coin acceptors and unique features of the TRC-6000 are noted therein. The specification does not implement changes from the original MC5 specification.

In the TRC-6000 standard, an electronic interface is provided between the coin acceptor 35 and an external control system in the case of a conventional vending machine, this controller is the vending machine controller. The acceptor validates coins from a United States (and optionally Canadian) coin set. Validated coins are accepted

and directed to either the inventory tubes or to an externally attached cash box.

Status messages are transferred to the control system as events are recognized by the coin acceptor 35. There are three classes of messages: 1) Coin message; 2) Non-Coin message; and 3) Tube Status message. The message transmission philosophy follows a traditional handshaking operation. The transmission mechanism for Coin and Non-Coin messages are detailed in FIG 9. In these cases, the acceptor shall hold off the transmission of a status message until such time as the control system indicates a readiness to receive the message. A retransmit mechanism is provided for and is also detailed in FIG 9. The transmission mechanism for Tube Status messages is detailed in FIG 10. This transmission is a result of disabling the acceptor through the /ACCEPT_ENABLE line. The rising edge of this signal causes the coin acceptor 35 to immediately send a message of this class. The control system must be prepared to receive this message when the /ACCEPT_ENABLE signal is deactivated. Since the request is asynchronous with respect to the activities occurring in the acceptor, such as coin validation, the message may not appear within the maximum time period shown in FIG 10.

Three types of Status Messages are used by this standard: Coin message, Non-Coin messages, and Tube Status messages. The messages in each class are described in turn.

The Coin Message class comprises a VALID COIN status message. This status message defines the value of the validated coin, the status of the three "empty" (lower) inventory tube sensors, and the destination of the validated coin, such as the cash box or the inventory tube. The format of the coin message is shown in FIG 11.

If a lower tube sensor is known to be defective, the coin acceptor 35 will report the status of this sensor to

the control system as being empty. There is currently no mechanism for reporting the status of the upper level tube sensors. A control system can infer that an upper level sensor is full if subsequent coins for that inventory tube are routed to the cash box. The control system can also determine that an upper level sensor is defective if coins for that inventory tube are routed to cash yet the lower level sensor status indicates empty.

The Non-Coin Message class comprises several status messages. Each message in the Non-Coin message class is described below. The hexadecimal values the message can have are also indicated. Each message can take on either of two hexadecimal values because bit D4 is used to send the status of the user selected routing option for the quarter inventory tube. If D4 is a zero (0) the state of the lower sensor shall be used to consider the state of the quarter inventory tube. If D4 is a one (1) the state of the upper sensor shall be used to consider the quarter inventory tube "full" condition.

The POWER UP status message indicates the coin acceptor 35 has just powered up, or has been RESET, and is ready for coin acceptance. This status message can take on the hexadecimal values 63H or 73H.

The DEFECTIVE SENSOR status message is sent once following power up if the acceptor has sensed a failed coin tube sensor (high or low). Note that if the failed sensor is an "empty" (lower) sensor the coin acceptor 35 will report that sensor "empty" regardless of its true status. This status message can take on the hexadecimal values 67H or 77H.

The ESCROW RETURN status message indicates the depression of the escrow return lever on the acceptor. Note that an escrow return message shall be transmitted even if the acceptor is inhibited by the /ACCEPT_ENABLE line. This

status message can take on the hexadecimal values 6EH or 7EH.

The SLUG message is sent when an invalid coin has been detected and returned to the customer via the reject slot. This status message can take on the hexadecimal values 6BH or 7BH.

The NO STROBE message is sent when a valid coin has been recognized but not detected passing through to the inventory tubes or to the coin box. This status message can take on the hexadecimal values 6FH or 7FH.

The DOUBLE ARRIVAL message is sent when two coins are presented to the coin acceptor 35 in rapid succession. The acceptor was unable to evaluate either coin. Both coins shall return via the reject slot. This status message can take on the hexadecimal values 23H or 33H.

The COIN JAM message is sent when a coin is detected by the coin acceptor 35 as being lodged between the acceptance gates. No further coins can be accepted until this mechanical jam is corrected. This status message can take on the hexadecimal values 27H or 37H.

The DOLLAR COIN NOT ACCEPTED message is sent when a dollar coin was detected but rejected because of prevailing conditions in the acceptor. The dollar coin shall not be accepted if the "empty" (lower) quarter tube sensor shows empty and the "low quarter ignore" user option is not in effect. The dollar coin shall not be accepted if the "dollar acceptance" user option is not in effect. The "dollar acceptance" user option is evaluated first by the acceptor and has highest priority. This status message can take on the hexadecimal values 03H or 13H.

A Tube Status Message is sent to the control system to indicate the current state of the lower inventory tubes. FIG 12 is an illustration which shows the format of the Tube Status message of the TRC-6000 interface. The Tube Status message is a new feature to the TRC-6000 acceptor.

The TRC-6000 standard also defines the input specification, including the input power and the control lines.

Power is to be +5 Volts DC (± 5% at 100 mA maximum). There is to be a 5 Volt Return Ground (Analog and Digital). Line Voltage is to be +117 Volts (± 10%) full-wave rectified, and be a non-filtered line. Peak current demand is approximately 650 mA. There is to be a +117 Volt Return Ground. The 117 Volt and the 5 Volt ground must not be connected together. Damage to both the coin acceptor 35 and the control system would occur under these conditions.

The input control lines comprise several different signals. The /ACCEPT_ENABLE is an active low input and is used as a gating signal for the purpose of coin acceptance. Coins are accepted when the signal is True (zero volts) and rejected when the signal is False (5 volts).

The /SEND is an active low input and is part of the "handshaking" protocol used to send Coin and Non-Coin messages to the control system. The /SEND signal can be used as an "Interrupt Acknowledge" response to a coin acceptor 35 "Interrupt Request." The /SEND signal should not be active at any other time. A re-transmit mechanism is provided to the control system once the handshake is underway.

Once the initial data message is received the control system can raise the /SEND line for a small period and then assert /SEND again to force the acceptor to retransmit the initial message.

If the control system raises /SEND for longer than the retransmit period the coin acceptor 35 assumes this communication session is ended. The acceptor will raise /INTERRUPT to indicate to the control system that the communication is finished. The acceptor then resumes normal operation in accordance with the /ACCEPT_ENABLE line and external stimuli.

There are three /DISPENSE control lines. They are active low input lines which control the dispensing of coins from the coin acceptor's inventory tubes. Each line is associated with a particular coin tube (nickel, dime, or quarter). The control system directly interfaces to the dispense circuitry. The acceptor has no knowledge of these lines or of the dispense function. Only one /DISPENSE line can be in the "active" (0 Volt) state at any given time because of power constraints. A /DISPENSE line can be activated by the control system at any time and is not inhibited by conditions in effect within the coin acceptor 35, such as /ACCEPT_ENABLE inactive, or /INTERRUPT asserted.

The /RESET signal is an active high input signal and is used to provide an orderly start and restart of the digital electronics within the acceptor. RESET must be held in the high (5 Volt) state for a minimum of 10 milliseconds to insure the proper reset of the coin acceptor 35. Once RESET, the coin acceptor 35 shall perform internal housekeeping and then report "ready" to the control system by activating /INTERRUPT. This process should occur within 2 seconds from the falling edge (5 Volt to 0 Volt) of the RESET signal. FIG 13 is an illustration which shows the interface circuitry associated with the input circuit. FIG 14 is an illustrations which shows the timing associated with some signals.

The TRC-6000 standard also defines the output signal standard specification for the control lines. An /INTERRUPT

output is provided which is active low output and which is part of the handshaking protocol used to send Coin and Non-Coin messages to the control system. The /INTERRUPT can be viewed as an "Interrupt Request" to the control system. Once /INTERRUPT is activated the acceptor will dedicate all processing to the communications link. The coin acceptor 35 will not look for coins or service escrow return requests. The acceptor is effectively inhibited by the need to communicate with the control system. When /INTERRUPT is asserted (0 Volt) the coin acceptor 35 waits for the control system to "acknowledge" the request by activating the /SEND line. Once the acceptor detects an active /SEND line the message is transmitted to the control system over the /DATA line. The coin acceptor 35 will retransmit the message if requested to do so by the control system.

The /DATA output signal is an active low output line which is used to transmit Coin or Non-Coin messages to the control system once handshaking has been satisfied. The data is sent as a serial stream (least significant bit first) in accordance with an NRZ (non-return to zero) format. The data is transmitted sequentially in time as follows: START_BIT, D0, D1, D2, D3, D4, D5, D6, D7, STOP_BIT. The START_BIT is a SPACE (0 Volt) bit and the STOP_BIT is a MARK (5 Volt) bit. The transmission occurs at 600 Baud (± 1% maximum deviation). This is equivalent to an individual bit time of approximately 1.667 milliseconds so that the entire message can be transmitted in 16.67 milliseconds. FIG 15 is an illustration which shows the interface circuitry associated with the output circuit. FIG 16 is an illustrations which shows the timing associated with some signals.

Standards for input and output electrical lines are also specified in the standard. The Input Lines are represented by a logical zero or logical one. For logical zero, Vin is in the range from 0.0 Volts to 0.4 Volts and Iin is a maximum of 7.0 milliamps. For logical one, Vin is

in the range from 4.6 Volts to 5.0 Volts and Iin is a maximum of 500 microamps.

The Output Lines are represented by a logical zero or logical one. For logical zero, Vin is in the range from 0.0 Volts to 0.4 Volts and Iin is a maximum of 16.0 milliamps. For logical one, Vin is in the range of the Open Collector Drivers and Iin is a maximum of 100 microamps.

All Input/output lines shall be housed in a 12 position JONES Plug Number P-312-CCT. The JONES mating connector is a 12 position socket number S-312-CCT. The input or output lines and their respective pin locations are as follows: +5 Volt supply (pin 1), +5 Volt return (pin 2), /SEND (pin 3), /INTERRUPT (pin 4), /DATA (pin 5), /ACCEPT_ENABLE (pin 6), /DISPENSE $.25 (pin 7), /DISPENSE $.10 (pin 8), /DISPENSE $.05 (pin 9), 117 Volt Supply Return (pin 10), RESET (pin 11), and 117 Volt Positive Supply (pin 12).

The TRC-6000 specification makes several recommendations and suggestions regarding preferred, but not required, operation of the system. These recommendations and suggestions are not detailed here.

The modular data card scanner 36 of the present invention is applicable to several types of existing vending machines. These applicable machines comprise vending machines denoted single-price, four-price, ten-price, multi-price and MicroMech machines. The configuration and operation of these conventional machines will be described so that the broad applicability of embodiments of the present invention may be better understood. Much of the material presented in this description may be found in publications by MARS Electronics, a major supplier of vending machine components. In particular, the contents of the "Installation, Operation & Service Manual for MC5 Coin Changers" published by MARS Electronics is incorporated by reference into this application. The Manual is supplied to

purchasers of Mars equipment and is widely available to workers in the field.

When a data card scanner 36 and scanner interface 39 are interposed between a coin acceptor 35 and a vending machine dispenser controller apparatus 38, appropriate signals must be passed through the interface (or be received and regenerated) or generated within the scanner 36 or scanner interface 39. The conventional signal requirements of several types of vending machines are described followed by a description of embodiments of several data card scanner interface 39 embodiments according to this invention.

In reference to FIG 17, therein is illustrated a block diagram of the connectivity of a conventional single-price, four-price, ten-price, and multi-price vending machine which incorporates both a bill acceptor 41 and a coin acceptor 35. When a bill acceptor 41 is present, it generally communicates through the coin changer 35, to the vending machine. There is generally no separate vending machine controller, although there may be some simple logic circuitry. The signals used in such a machine are comparatively simple and the configuration does not need to include a separate controller.

In reference to FIG 18, therein is illustrated an 8-pin coin acceptor plug which is used to connect the coin acceptor mechanism 35 to the dispense portion of the vending machine for a single price machine. The data scanner interface 39 comprises connectors appropriate to the type of vending machine it is installed into, such as a MicroMech type, so that the only electrical installation work involved is to unplug and plug a small number of connectors.

In reference to FIG 19, therein is an illustration which diagrammatically shows the coin mechanism/vending machine interface for a single price escrow to vend type machine. The figure illustrates the identity of the signals

passed, and their respective pin assignment, between the coin changer 35 and the vending machine. The figure also discloses typical electronic circuitry of each side of the interface as may generally be used in the coin acceptor mechanism 35 and the product dispensing controller 38 and product dispensing apparatus 37. The signals required for proper operation are an exact change indicator line (pin 5), an AC voltage neutral line (pin 2), an AC voltage hot line (pin 1), a vend (n.o.) line (pin 3), a blocker line (pin 6), and a vend (n.c.) line (pin 7). Pin 4 and pin 8 are not used, although in some single price full escrow to select vending machines, pin 8 is used for the escrow to select option.

FIG 20 is an illustration which shows diagrammatically the coin mechanism/vending machine interface for a single price full escrow to select type machine. The figure illustrates the identity of the signals passed, and their respective pin assignment, between the coin changer 35 and the vending machine required for operation in this type of system. The figure also discloses typical electronic circuitry of each side of the interface as may generally be used in the coin acceptor mechanism 35 and the product dispensing controller 38 and product dispensing apparatus 37. The signals required for proper operation are an exact change indicator line (pin 5), an AC voltage neutral line (pin 2), an AC voltage hot line (pin 1), a vend line (pin 3), a blocker line (pin 6), and a escrow to select sense line (pin 8). Pin 7 is an alternate switch position of vend line from the coin changer 35 but is not used by the vending machine. Pin 4 is not used in this configuration.

FIG 21 is an illustration which shows an 8-pin coin acceptor mechanism plug and its associated connector pin signal assignments which is used to connect the coin mechanism to the dispense portion of the vending machine for a four price machine.

FIG 22 is an illustration which shows a diagrammatic representation of a typical coin acceptor 35 mechanism portion of the coin changer/vending machine interface for one type of four-price vending machine. The figure illustrates the identity of the signals passed, and their respective pin assignment, between the coin changer 35 and the vending machine as required for operation in this type of system. The figure also discloses typical electronic circuitry of one side of the interface as may generally be used in the coin acceptor mechanism 35. The signals required for proper operation are an exact change indicator line (pin 5), an AC voltage neutral line (pin 2), an AC voltage hot line (pin 1), a blocker line (pin 6), a price 1 line (pin 3), a price 2 line (pin 4), a price 3 line (pin 7), and a price 4 line (pin 8).

FIG 23 is an illustration which shows the vending machine side of the interface illustrated in FIG 22. The pin associated with each line are as indicated for the coin changer 35 portion in FIG 22. The figure also discloses typical electronic circuitry of one side of the interface as may typically be used in the product dispensing controller 38 and product dispensing apparatus 37.

FIG 24 is an illustration which shows a 18-pin coin mechanism plug and associated pin signal assignments which is used to connect the coin acceptor mechanism 35 to the dispense portion of the vending machine for a ten-price machine.

FIG 25 is an illustration which shows the coin mechanism portion of the coin changer/vending machine interface for a typical ten-price vending machine. The figure illustrates the identity of the signals passed, and their respective pin assignments, between the coin changer 35 and the vending machine as required for operation in this type of system. The signals required for proper operation are an exact change indicator line (pin 5), an AC voltage neutral

line (pin 8 or 17 depending on type of changer), an AC voltage hot line (pin 1), a blocker line (pin 6), a price 1 line (pin 8), a price 2 line (pin 9), a price 3 line (pin 10), a price 4 line (pin 11), a price 5 line (pin 12), a price 6 line (pin 13), a price 7 line (pin 14), a price 8 line (pin 15), a price 9 line (pin 16), and a price 10 line (pin 17).

The vending portion of the interface for the ten-price machine has corresponding signal lines and pin assignments and is not illustrated.

FIG 26 is an illustration which shows a 18-pin coin mechanism plug which is used to connect the coin mechanism to the dispense portion of the vending machine for a non-MicroMech multi-price machine. Also identified are the signals associated with the 18-pin plug connector.

FIG 27 is an illustration which shows the coin changer/vending machine interface for a multi-price vending machine. The figure illustrates the identity of the signals passed, and their respective pin assignments, between the coin changer 35 and the vending machine required for operation in this type of system. The figure also discloses typical electronic circuitry of each side of the interface as may generally be used in the coin acceptor mechanism 35 and the product dispensing controller 38 and product dispensing apparatus 37. The signals required for proper operation are an exact change indicator line (pin 5), an AC voltage neutral line (pin 14), an AC voltage hot line (pin 15), a blocker line (pin 6), a vend drive line (pin 16), a price $.05 line (pin 9), a price $.10 line (pin 10), a price $.20 line (pin 11), a price $.40 line (pin 12), a price $.80 line (pin 13), and a price $1.60 line (pin 17). Pins 1, 2, 3, 4, 7, 8, and 18 are not used.

In a conventional vending machine system, the MicroMech type system transmits data to an external vending machine

controller through its Interrupt and Data lines. The controller responds through its Send line. The Interrupt, Data, and Send lines form a serial data link between the coin changer 35 and vending machine controller 80. The controller 80 supplies power to operate the changer 35 via its four power lines. The controller 80 also has five control lines that provide for Coin Payout ($.05, $.10, or $.25), Enable/Inhibit Coin Acceptance, and Reset the changer to its standby condition. These signals are described in greater detail subsequently.

In reference to FIG 28 there is illustrated a block diagram of the major components of a conventional MicroMech based vending machine, or other vending machine having a separate vending machine controller board. The configuration illustrated comprises a coin acceptor 35, a bill validator 41, a controller board 80, a credit display 81, and the dispense portion of the vending machine 82. Neither the bill acceptor nor the credit display are required for operation, although they enhance the configuration.

In reference to FIG 29 there is an illustration which shows the 12-connector coin mechanism plug for a MicroMech interface. The signals and respective pin assignments are: 5 Volt DC (pin 1), 5 Volt DC supply return (pin 2), Send (pin 3), Interrupt (pin 4), Data (pin 5), Accept Enable (pin 6), $.25 Dispense (pin 7), $.10 Dispense (pin 8), $.05 Dispense (pin 9), 117 Volt or 24 Volt DC supply return (pin 10), Reset (pin 11), and 117 Volt or 24 Volt DC supply positive (pin 12). The provision of 117 Volt or 24 Volt supply is determined by the particular characteristics of the vending machine.

In FIG 30 is illustrated a MicroMech coin changer 35 to electronic vending machine interface. The signals required to be passed between the coin mechanism 35 and the vending machine controller 80 are as indicated in FIG 29. The

MicroMech based vending machine, unlike the single-, ten-, and multi-priced vending machines, has a separate vending machine controller 80. The MicroMech based machine uses the standard interface signals (MC5, MC5000, TRC-6000, or variants thereof) described elsewhere in this description.

Other coin acceptor 35 to vending machine standards may exist or be developed in the future. The critical point is that all the coin acceptors 35 generate or respond to a limited number of signal lines. The coin acceptor 35 unit is not required for operation if the proper generation and response between the coin acceptor 35 and the vending machine, or the coin acceptor 35 and a vending machine controller 80 is supplied by a non-currency substitute unit. The modular data card scanner 36 provides these signals.

Each of the several embodiments of the invention comprises a data card scanner 36. The incorporation of a data card scanner 36 into the vending machine system advantageously solves many of the problems associated with conventional coin, paper currency, and bank credit card type unattended vended sales. The data card scanner 36 can be implemented by incorporating various information storage and retrieval technologies. These options include, but are not limited to, magnetic reader/writer scanning units, electronic information storage and retrieval reader/writer scanner technologies, and optical reader/record scanning units.

In one embodiment of the invention, the means for data card scanning is implemented with a data card scanner 36 apparatus such as that illustrated in FIG 31, for example. This data card scanner 36 incorporates a linear scanning mechanism and is completely described in U.S. Patent Application Serial No. 07/777,736 filed on October 11, 1991 and incorporated by reference herein, which is copending with this application. Alternatively, the data card scanner 36 may be realized by incorporating a rotary

scanner, for example, which is completely described in U.S. Patent Application Serial Number 697,944 filed May 9, 1991. This scanner incorporates a rotary scanning mechanism. The respective linear and rotary scanner applications also disclose the structures of a data cards used in conjunction with the respective data card scanner 36, including there information storage structures and operation.

While the inclusion of a data card scanner 36 in a vending machine need not be in an add-on or retrofit embodiment, a scanner 36 capable of retrofit installation has advantages which contribute to satisfying the needs unsolved by conventional systems. The data card scanner 36 comprises several features which provide its modular retrofit capabilities. Its scanning mechanism is mechanically modular, the scanner hardware is compatible with a broad class of applications, the electrical scanner interface 39 hardware to the vending application is relatively simple and can be simply changed, and the firmware can be selected and configured by a minimum of field programming during data card scanner and interface installation. A data card scanner having overall dimensions of approximately 6.4 by 3.42 by 5.22 (L, W, H) inches has the appropriate geometrical form factor to be accommodated into a standard bill validator vending machine slot.

These features provide a payment acceptance apparatus that is retrofittably adaptable to dispensing machines selected from a plurality of dispensing machine types, each of the dispensing machine types potentially having different defined control signal characteristics for dispensing. The apparatus may be configured or reconfigured to receive electrical signals from various payment devices and to generate and transmit electrical signals to the dispensing machine which are specially adapted to the defined control signal characteristics of the particular type and class of dispensing machine.

In reference to FIG 32 there is illustrated a block diagram of a vending machine system according to one embodiment of this invention, which does not utilize a separate controller. This type of system has been described in the context of single-, four-, ten- and multi-priced vending machines. This figure illustrates that the modular replacement data card scanner 36 and scanner interface 39 supplies and receives signals to and from the vending machine in conceptual parallelism to the coin changer 35. The actual interface 39 described in detail below, provides for some isolation between the two sets of signals so that they are not actually electrically wired together. The parallelism may also be accomplished by passing the coin acceptor 35 signals through the data card scanner interface 39. The signals required for operation been previously indicated in the descriptions of the single-, four-, ten- and multi-priced vending machines. Embodiments of scanner interfaces 39 for these machines will be described subsequently.

In reference to FIG 33 there is illustrated a block diagram of a vending machine system according to another embodiment of this invention which utilizes a separate controller; such as the MicroMech based system. In this type of system, the modular data card scanner 36 and scanner interface 39 are interposed between the coin changer 35 and the controller board 80 of the vending machine system. While the connections are made to the scanner interface 39, the data card scanner which contains the scanner controller and firmware are also effectively interposed because the data card scanner controller communicates with the scanner interface 39.

In reference to FIG 34 there is illustrated an interconnection diagram of an embodiment of a data card scanner interface controller PCB 138 for an embodiment of a linear data card scanner 36 as disclosed in U.S. Patent Application Serial No. 07/777,736. This figure diagrammatically illus-

trates scanner controller elements which supply the signals necessary for either a single price vending machine or a multi-price vending machine.

For a single price vending machine, the Controller PCB 138 is configured to provide the required signals for a single price application 498 and provides six signals via connector J1: an Exact Change line, a Sense line, a Blocked line, a Vend line, and two ground lines. In the context of the general discussion of the data card scanner interface 39, the single-price application 498 is equivalent to the scanner interface 39.

For a vending machine involving a more complex pricing system, there may be need to communicate with an application scanner interface 496 which provides the signals necessary for operation of the particular vending machine application. In this more detailed diagram, the application interface PCB is equivalent to the data card scanner interface 39 previously described in more general terms. The four-, ten-, and multi-price machines, and the MicroMech vending machines are examples of such complexity. The MicroMech application allows a consumer to select one of a number of goods from a vending machine having a multiplicity of prices for different items. This application may require up to 24 input/output ports which the scanner controller PCB 138 provides.

By way of example, FIG 35 illustrates how the scanner interface 39 may be interposed between a coin acceptor 35 and a vending machine controller board 80 as illustrated diagrammatically in FIG 33. In FIG 35 there is shown a Scanner Interface Controller PCB port 90, a Scanner Interface-to-Vending Machine Controller port 91, and a Scanner Interface-to-Coin Acceptor port 92. This illustration diagrammatically illustrates an embodiment of how the scanner interface 39 may be interposed between the coin acceptor 35 and the vending machine controller. Proper

male/female plugs, such as those illustrated in FIG 29, are provided so as to allow the coin acceptor 35 to be unplugged from the vending machine controller 80 and plugged into the scanner interface 39, and then the scanner interface 39 may be plugged into the vending machine controller 80.

The Scanner Interface Controller PCB port 90 is also illustrated in FIG 34. This port transmits and receives signals form the vending machine controller 80 and a coin acceptor apparatus. The signals present at the scanner interface controller port 90 are the /ACCEP EN, /SEND, RESET, /DISP 05c, /DISP 10c, /DISP 25c, /INT, /DATA, *DISP 05c, *DISP 10c, *DISP 25c, *RESET, *SEND, *ACCP EN, *DATA, and *INT. Other scanner interface controller ports are not used for this interface application.

The vending machine controller transmits the /ACCEP EN, /SEND, RESET, /DISP 05c, /DISP 10c, /DISP 25c, /INT, and /DATA signals to the scanner interface controller port 90 by way of electrical lines incorporating signal conditioning and circuit protection circuitry. Each signal passes through a resistor 93, and has some capacitive filtering provided by a capacitor 94 to ground, a diode 95 is in parallel to the capacitor 94. Pull-up resistors 98 are connected to a +5 volt supply 96, and in parallel to a diode 97. Amplifiers 99 are also provided in the signal path. These signal conditioning and protection components are provided because of the potentially uncertain load or signal characteristics of the vending machine controller. The ground form the vending machine controller is not transmitted over the interface to the scanner interface controller ports 90.

The *DISP 05c, *DISP 10c, *DISP 25c, *RESET, *SEND, *ACCP EN, *DATA, and *INT signals are communicated between the scanner interface controller 90 and the coin acceptor ports 92. The *DATA and *INT are communicated from the coin acceptor ports 92 to the scanner interface controller ports

90 and are provided with signal conditioning and protection circuitry as described above. The rest of the signals are sent by the interface controller to the coin acceptor ports 92 have only an amplifier 100 in the signal path. The ground from the coin acceptor port 92 is not communicated to the scanner interface controller ports 90.

FIG 36 is an illustration which shows a scanner interface 39 for a single-price vending machine application. The conceptual parallelism between the coin changer 35 and the data card scanner 36 is achieved by inputting the signals from the coin changer 35 to the scanner interface 39. Signals to the product dispensing apparatus 37 can then be generated by either the coin changer 35 or the data card scanner 36. Optical isolation 95 between the coin changer 35 and the signal generation portion of the scanner interface 39 is used to provide electrical isolation while permitting the signal information to be transmitted.

FIG 37 is an illustration which shows an embodiment of a scanner interface 39 for a four-price vending machine application. The data card scanner controller 138 communicates with the scanner interface 39 through four sense lines, four vend lines, and one sense blocker line. The scanner interface 39 communicates with the vending machine 96 through four price lines and one blocker line. Electrical power is also supplied to the vending machine dispense portion through the scanner interface 39 and power supply.

While the previous discussion and diagrams illustrated the electrical scanner interface 39 and connections for single-price, four-price and MicroMech systems, it will be clear to a person in the art that the same principles apply to other vending machines, albeit with somewhat different interface electronics and signals. The data card scanner 36 hardware is the same for each of these applications. Only the scanner interface 39 hardware changes between

applications, and the portion of firmware, which is integral to the scanner apparatus, to be used in the application is selected by simple field programming during installation. In each case the data card scanner interface 39 in cooperation with the data card scanner hardware, firmware, and software generate electrical signals appropriate to the type of vending machine in which it is installed when the card indicates that proper payment may be accepted from the data card.

An embodiment of the present invention provides for a data card scanner 36 which is modular and has external physical characteristics, including linear dimensions, mounting flanges, weight, and interface connections, such that it may be easily mounted into the space previously occupied by the standard bill validator 41. This retrofit feature may be accomplished without structural modification of the dispensing machine housing 31, including without cutting additional holes. The modular data card scanner 36 may also be installed in a dispensing machine which was designed to incorporate a bill validator 41. In this instance the physical installation, including modifications to the dispensing machine front panel 52, is substantially the same as for a standard bill validator 41.

This modular data card scanner 36 may comprise the linear data card scanner with moving transducer described in U.S. Patent Application Serial No. 07/777,736 filed October 11, 1991, or the rotary scanner described in U.S. Patent Application Serial Number 697,944 filed May 9, 1991.

The modular data card scanner 36 is illustrated in FIG 38. FIG 39 is an illustration which shows a standard template 51 for the dispensing machine front panel 52 cutout and mounting hole 53 pattern. FIG 39 also illustrates the standard mounting bezel 54 which comprises a plurality of threaded fasteners 55 for coupling to a bill validator 41, or in this case to a data card scanner 60 on a interior side

59 of the dispensing machine front panel 52 using a plurality of washers 56 and a plurality of threaded fasteners to mate to threaded fasteners 54.

The particular embodiment of the modular data card scanner 60 comprises a substantially rectangular box 64 wherein are contained the devices and components necessary or desirable for data card scanning operation. One scanner end 63 of the data card scanner 60 projects through a panel in the dispensing machine having a hole 58 so that a customer may access the data card scanning apparatus, and the dispensing machine, by presenting a data card. A mounting flange 61 surrounds four sides proximate the scanner end 63, and has engagement structures 62 to cooperate with the threaded fasteners 55 of the mounting bezel 54 so that the data card scanner 60 may be mounted to the dispenser panel. Other mounting schemes are possible. The actual dimensions of the data card scanner 60 may be different from those of the standard bill acceptor; however, the modular data card scanner 60 will be mountable on a dispensing machine.

The mounting flange 61 of the data card scanner 60 comprises a substantially planar plate 61 of a material with sufficient strength to provide secure mounting and use without sustaining damage. The mounting flange has slots, holes, or other similar structures 62 which are appropriately sized to permit a fastener, such as a threaded screw, to pass through the slot or hole without binding.

A significant feature of the invention is the provision of a means for retaining possession of a data card when the data card is defective or has predetermined characteristics. This capability is referred to as card swallowing and is provided by the data card scanner 36 transport mechanism. This transport mechanism is described in U.S. Patent Application Serial No. 07/777,736, filed October 11, 1991 and herein incorporated by reference. One such

predetermined characteristic is identification of the card as a promotional use card intended for one-time or limited use. In such cards, the card contains information identifying it as a promotional card. For example, the information encoded in the card may restrict use of the card to the purchase of a particular product or alternately, restrict the purchase to a particular monetary value. Virtually any combination of products, monetary credits, valid use locations, and so on can be encoded in the information so that the promotional card can be tailored to particular products, product discounts, market segments, machines, and so on.

In an embodiment of the invention, the card swallowing feature is integrated with the device that provides a data card scanner 36. A card may be retained within the data card scanner 36 by commands to the data card positioning assembly that moves the card through the scanner apparatus to a receiving location outside of the data card scanner 36 but in the interior of the dispensing machine for later collection, rather than presenting the card to the exterior of the machine for extraction by the user.

In reference to FIG 38 there is shown an embodiment of a modular scanner with a separate power supply and scanner interface 39 unit separate from the data card scanner apparatus 36. The scanner is connected to the power supply/ interface unit by a communication link, which may be a multi-wire electrical cable. Other communication links are possible. In this embodiment the power supply and interface 39 unit are located somewhat remotely from the scanner unit, and may be placed substantially anywhere within the vending machine container where space is available. The cable length may be reasonably extended by the use of additional extension cables where necessary.

While a particular embodiment of the invention has been described in detail, it will be understood that the

invention may be implemented through alternative embodiments. Thus, the scope of the present invention is not intended to be limited to the embodiment described above, but is to be defined by the appended claims.

WHAT IS CLAIMED IS:

1. A payment acceptance apparatus retrofittably adaptable to a dispensing machine selected from a plurality of dispensing machine types, each said dispensing machine type having different defined control signal characteristics, for dispensing products from a dispensing machine upon user request and payment, said apparatus comprising:

means for accepting cash payment and generating first electrical signals indicative of an amount of cash accepted;

means for scanning a data card and acquiring payment information in the form of second electrical signals;

means for interfacing said first and second electrical signals with said dispensing machine to indicate proper payment, said means for interfacing being reconfigurable to receive said first and second electrical signals and to generate and transmit third electrical signals to said dispensing machine which are specially adapted to said defined control signal characteristics of said dispensing machine, whereby said payment acceptance apparatus is retrofittable to and electrical signal compatible with said plurality of different dispensing machine types.

2. A dispensing machine payment acceptance apparatus as in Claim 1 wherein:

said means for accepting cash payment is a coin acceptor.

3. A dispensing machine payment acceptance apparatus as in Claim 1 wherein:

said means for accepting cash payment is a bill acceptor.

4. A dispensing machine payment acceptance apparatus as in Claim 1 wherein:

said means for accepting cash payment comprises a coin acceptor and a bill validator.

5. A dispensing machine payment acceptance apparatus as in Claim 1, additionally comprising:

means for swallowing said data card when said data card is defective.

6. A dispensing machine payment acceptance apparatus as in Claim 1, additionally comprising:

means for swallowing said data card when said data card has predetermined characteristics.

7. A dispensing machine payment acceptance apparatus as in Claim 6, wherein:

said predetermined characteristics comprise identification as a promotional limited-use card.

8. A dispensing machine payment acceptance apparatus as in Claim 1, wherein:

said means for scanning a data card and acquiring payment information in the form of electrical signals has a geometrical form factor substantially similar to a standard bill validator apparatus.

9. A payment acceptance apparatus retrofittably adaptable to a dispensing machine selected from a plurality of dispensing machine types, each said dispensing machine type having different defined control signal characteristics, for dispensing products from a dispensing machine upon user request and payment, said apparatus comprising:

means for scanning a data card and acquiring payment information in the form of first electrical signals;

means for interfacing said first electrical signals with said dispensing machine to indicate proper payment, said means for interfacing being reconfigurable to receive said first electrical signals and to generate and transmit electrical signals to said dispensing machine which are specially adapted to said defined control signal characteristics of said dispensing machine, whereby said payment acceptance apparatus is retrofittable to and electrical

signal compatible with said plurality of different dispensing machine types.

10. A dispensing machine payment acceptance apparatus as in Claim 9, additionally comprising:

means for swallowing said data card when said data card is defective.

11. A dispensing machine payment acceptance apparatus as in Claim 9, additionally comprising:

means for swallowing said data card when said data card has predetermined characteristics.

12. A dispensing machine payment acceptance apparatus as in Claim 11, wherein:

said predetermined characteristics comprise identification as a promotional limited-use card.

13. A dispensing machine payment acceptance apparatus as in Claim 9, wherein:

said means for scanning a data card and acquiring payment information in the form of electrical signals has a geometrical form factor substantially similar to a standard bill validator apparatus.

14. A payment acceptance apparatus retrofittably adaptable to a dispensing machine selected from a plurality of dispensing machine types, each said dispensing machine type having different defined control signal characteristics, for dispensing products from a dispensing machine upon user request and payment, said apparatus comprising:

a coin acceptor apparatus;

a data card scanner apparatus;

a data card scanner interface;

said data card scanner interface being reconfigurable to receive electrical signals from said coin acceptor and from said data card scanner and to generate and transmit

electrical signals to said dispensing machine which are specially adapted to said defined control signal characteristics of said dispensing machine, whereby said payment acceptance apparatus is retrofittable to and electrical signal compatible with said plurality of different dispensing machine types.

15. A dispensing machine payment acceptance apparatus as in Claim 14, additionally comprising:

means for swallowing said data card when said data card is defective.

16. A dispensing machine payment acceptance apparatus as in Claim 14, additionally comprising:

means for swallowing said data card when said data card has predetermined characteristics.

17. A dispensing machine payment acceptance apparatus as in Claim 16, wherein:

said predetermined characteristics comprise identification as a promotional limited-use card.

18. A payment acceptance apparatus retrofittably adaptable to a dispensing machine selected from a plurality of dispensing machine types, each said dispensing machine type having different defined control signal characteristics, for dispensing products from a dispensing machine upon user request and payment, said apparatus comprising:

a coin acceptor apparatus;

a bill validator;

a data card scanner apparatus;

a data card scanner interface;

said data card scanner interface being reconfigurable to receive electrical signals from said coin acceptor, from said bill validator and from said data card scanner and to generate and transmit electrical signals to said dispensing machine which are specially adapted to said defined control

signal characteristics of said dispensing machine, whereby said payment acceptance apparatus is retrofittable to and electrical signal compatible with said plurality of different dispensing machine types.

19. A dispensing machine payment acceptance apparatus as in Claim 18, additionally comprising:

means for swallowing said data card when said data card is defective.

20. A dispensing machine payment acceptance apparatus as in Claim 18, additionally comprising:

means for swallowing said data card when said data card has predetermined characteristics.

21. A dispensing machine payment acceptance apparatus as in Claim 20, wherein:

said predetermined characteristics comprise identification as a promotional limited-use card.

22. A modular means for scanning a data card retrofittably adaptable to a dispensing machine selected from a plurality of dispensing machine types, each said dispensing machine type having different defined control signal characteristics, for dispensing products from a dispensing machine, said modular means comprising:

means for scanning a data card and acquiring payment information in the form of first electrical signals;

means for interfacing said first electrical signals with said dispensing machine to indicate proper payment, said means for interfacing being reconfigurable to receive said first electrical signals and to generate and transmit second electrical signals to said dispensing machine which are specially adapted to said defined control signal characteristics of said dispensing machine, whereby said payment acceptance apparatus is retrofittable to and electrical signal compatible with said plurality of different dispensing machine types;

said means for scanning a data card and acquiring payment information in the form of electrical signals having a standard bill validator form factor.

23. A modular means for scanning a data card as in Claim 22, additionally comprising:

means for swallowing said data card when said data card is defective.

24. A modular means for scanning a data card as in Claim 22, additionally comprising:

means for swallowing said data card when said data card has predetermined characteristics.

25. A modular means for scanning a data card as in Claim 24, wherein:

said predetermined characteristics comprise identification as a promotional limited-use card.

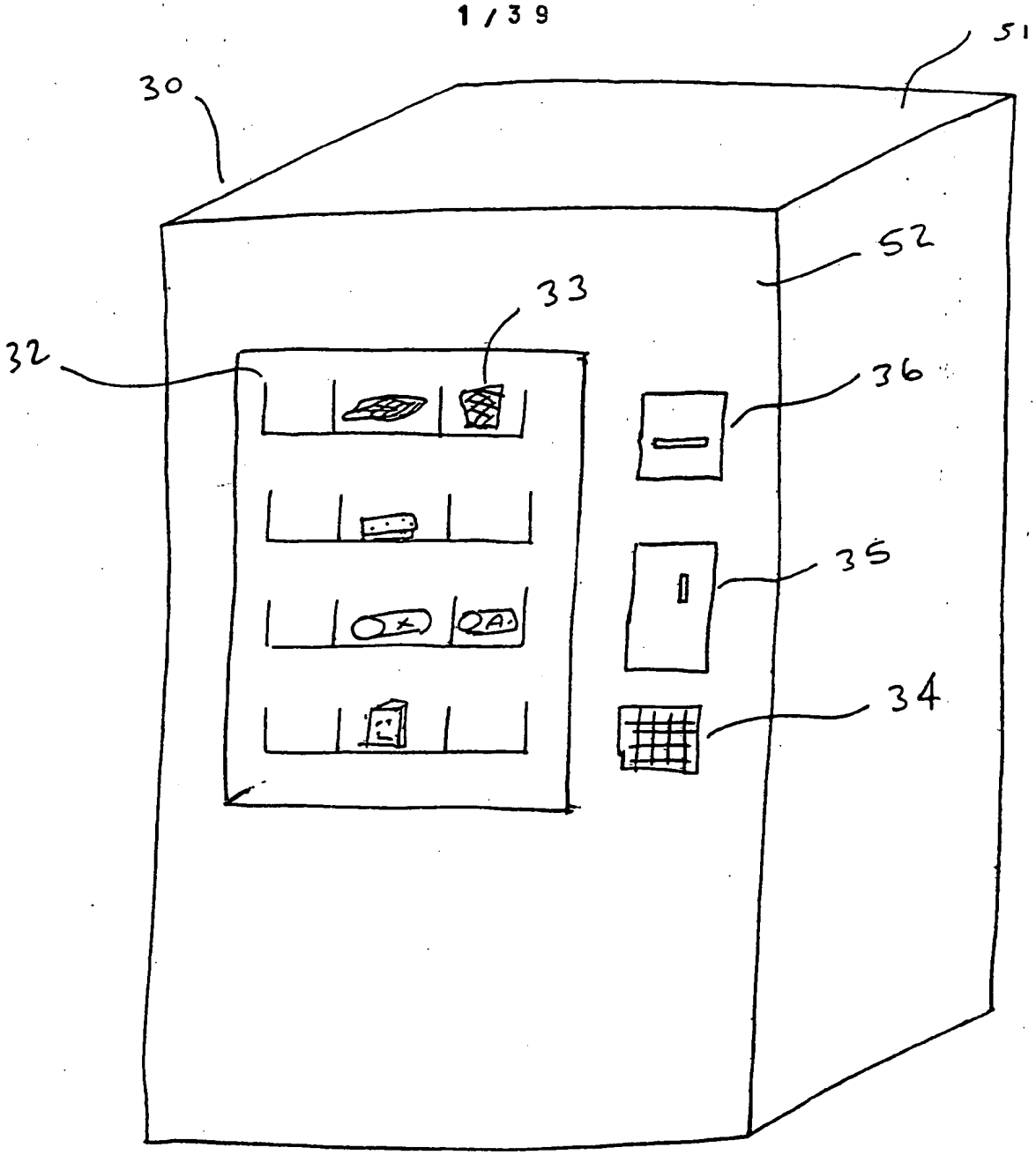


FIG. 1

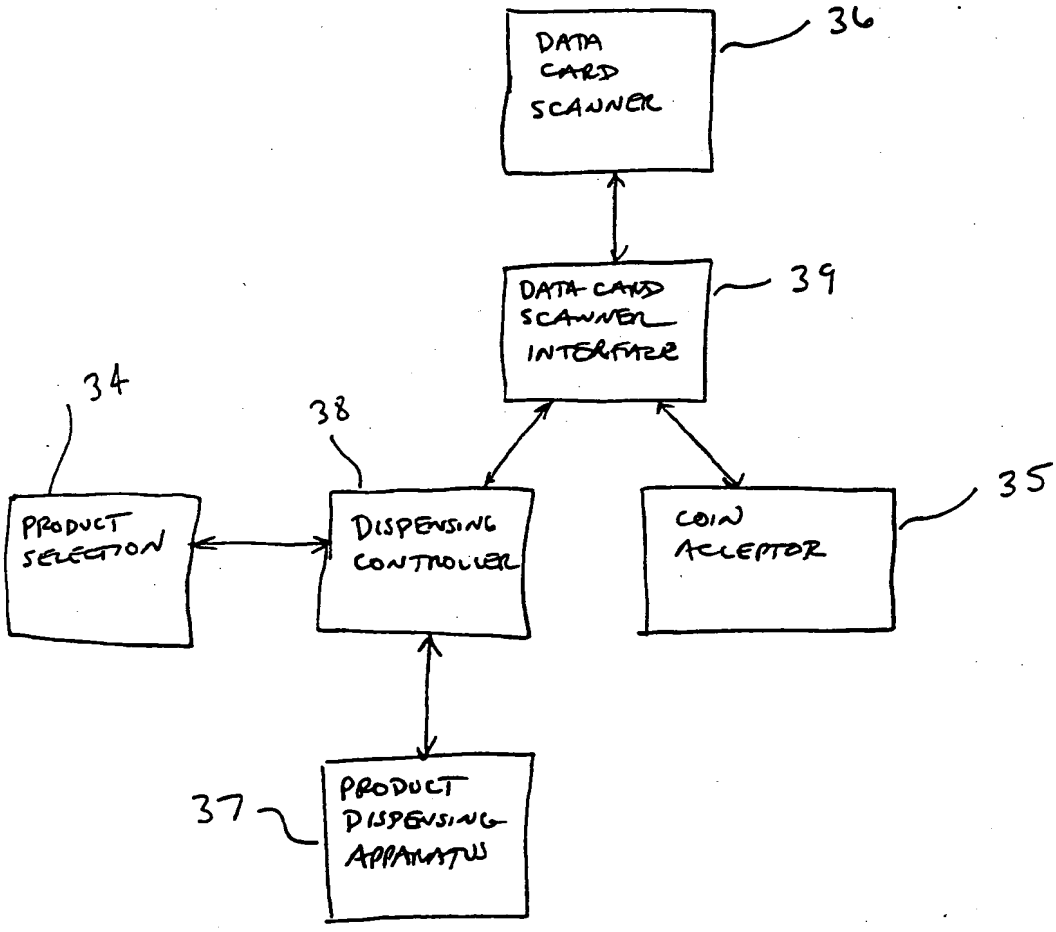
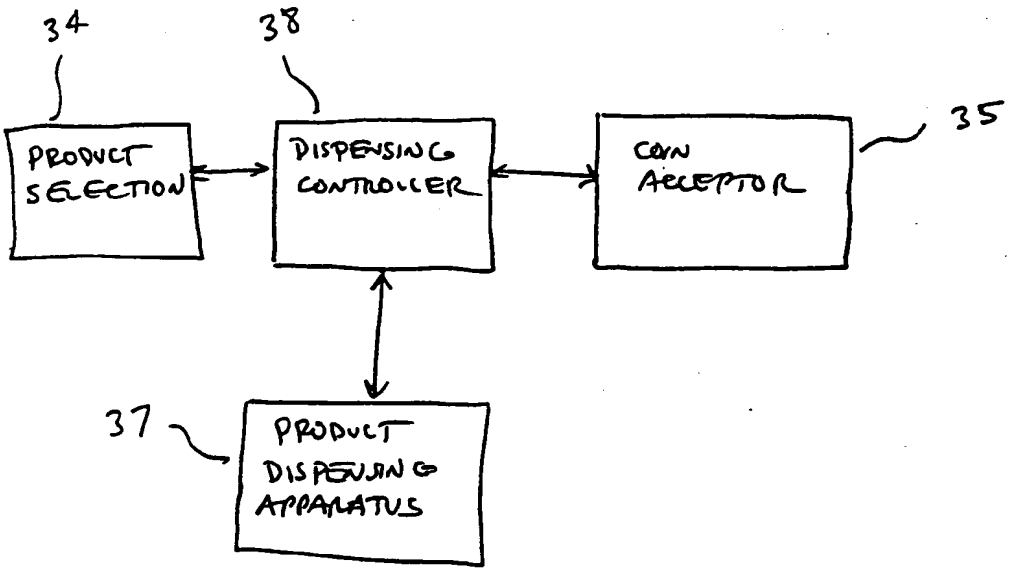


FIG. 2



[Prior Art]

FIG. 3

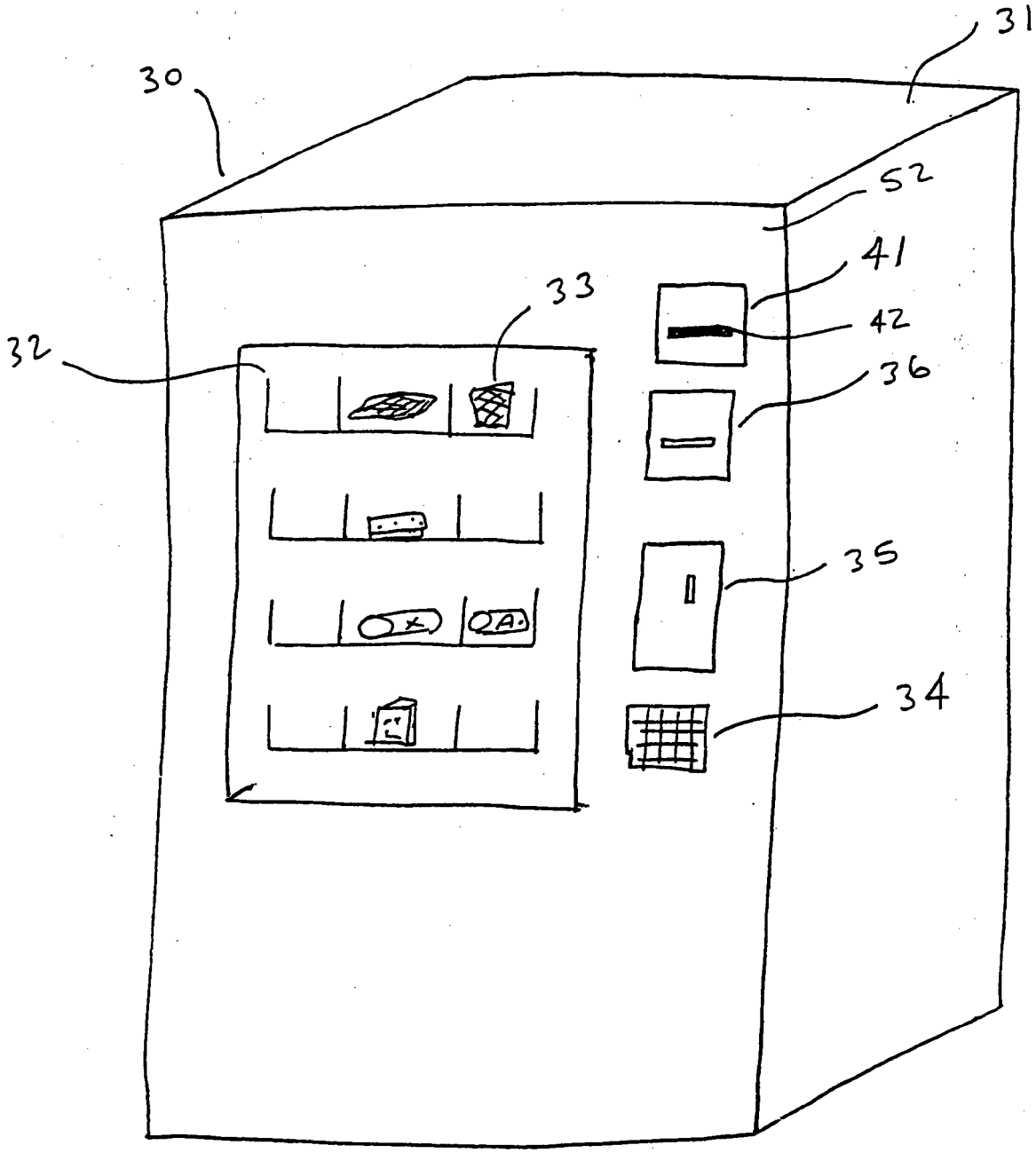


FIG. 4

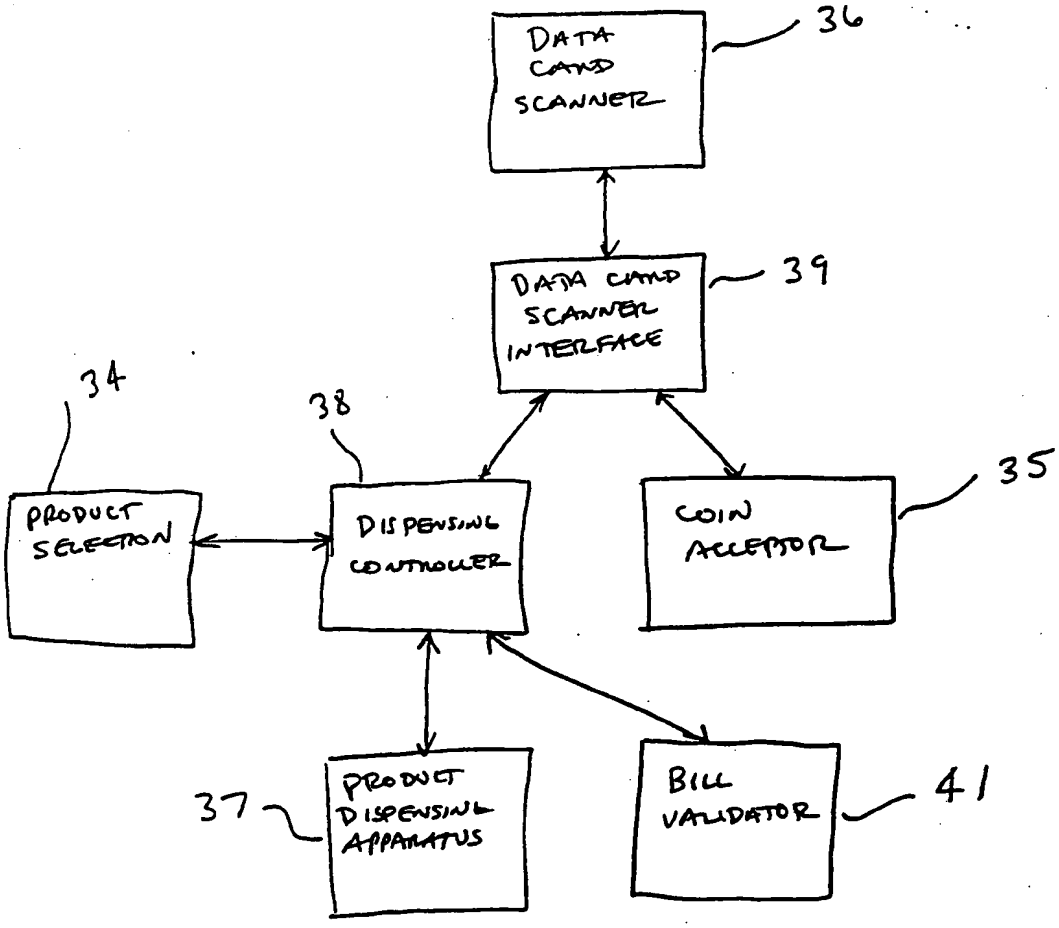

DATA CARD SCANNER
36
DATA CARD SCANNER INTERFACE
39
34
38
PRODUCT SELECTION
DISPENSING CONTROLLER
COIN ACCEPTOR
35
37
PRODUCT DISPENSING APPARATUS
BILL VALIDATOR
41

FIG. 5

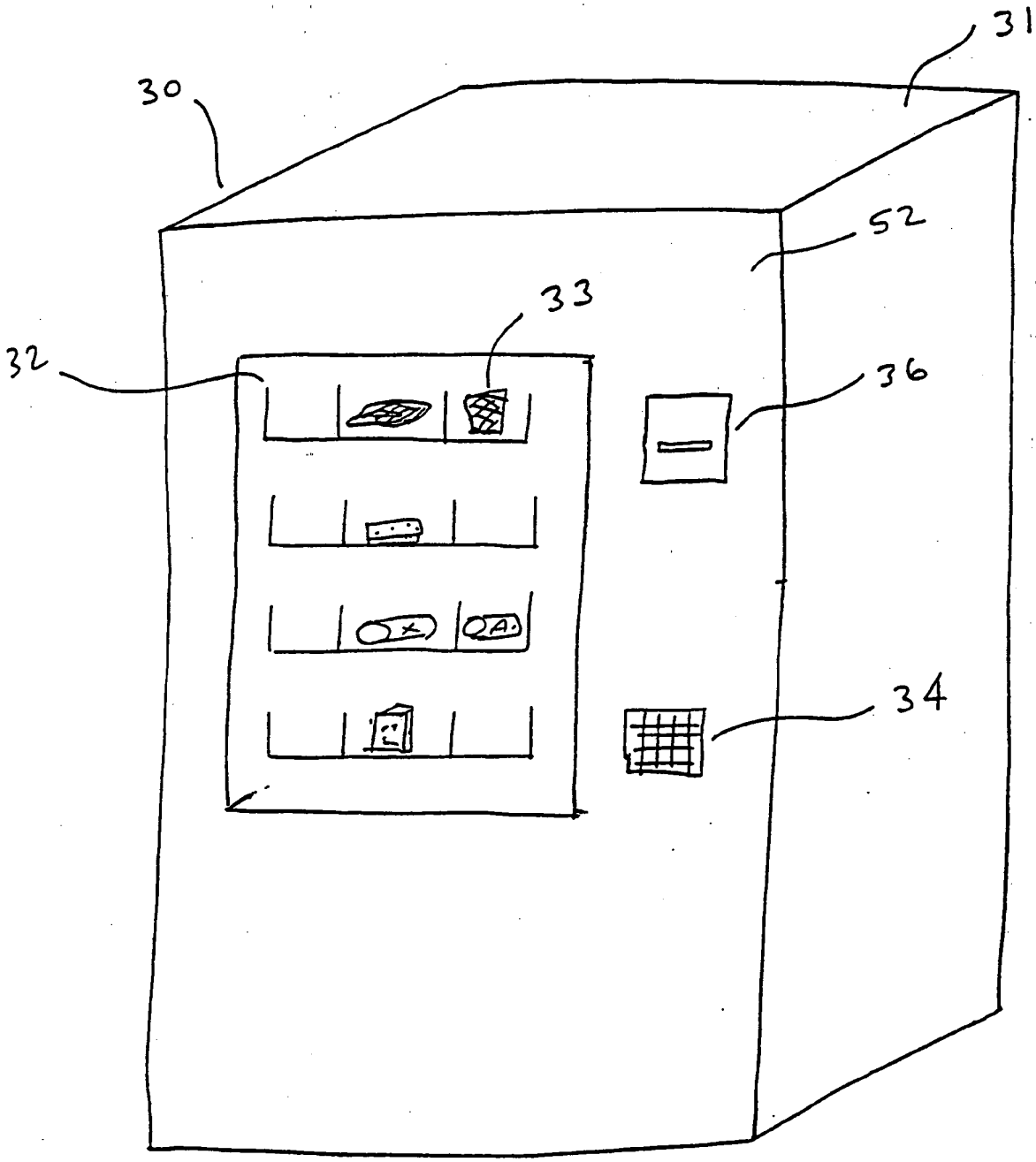


FIG. 6

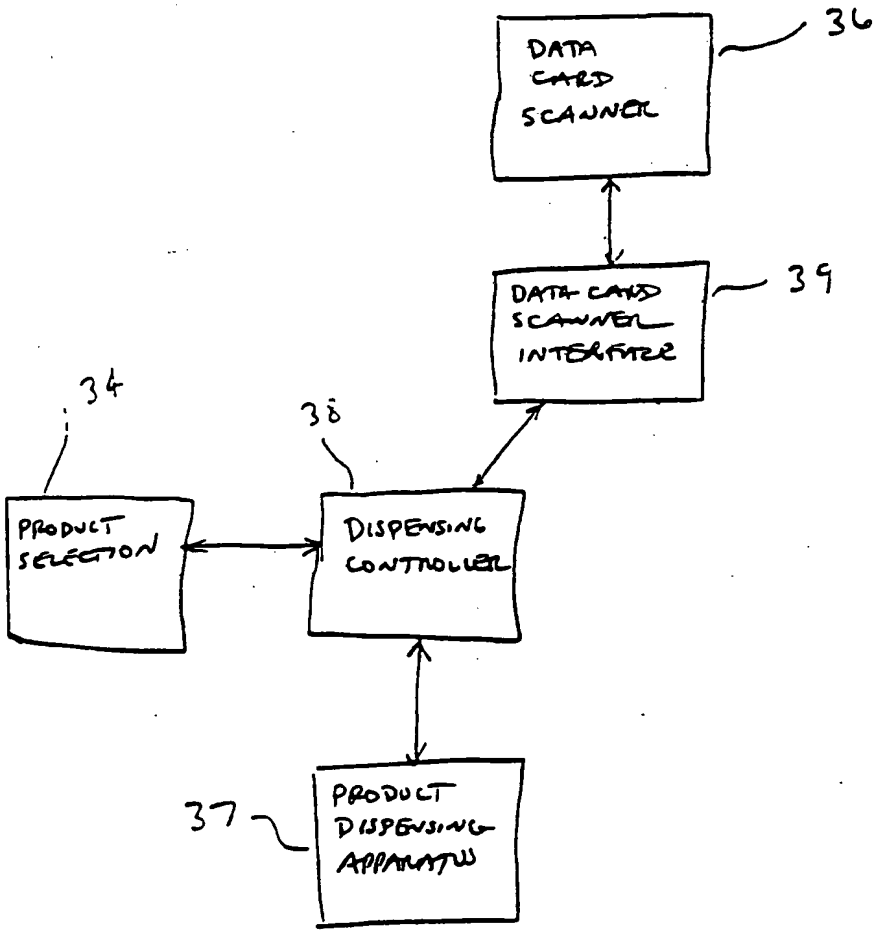
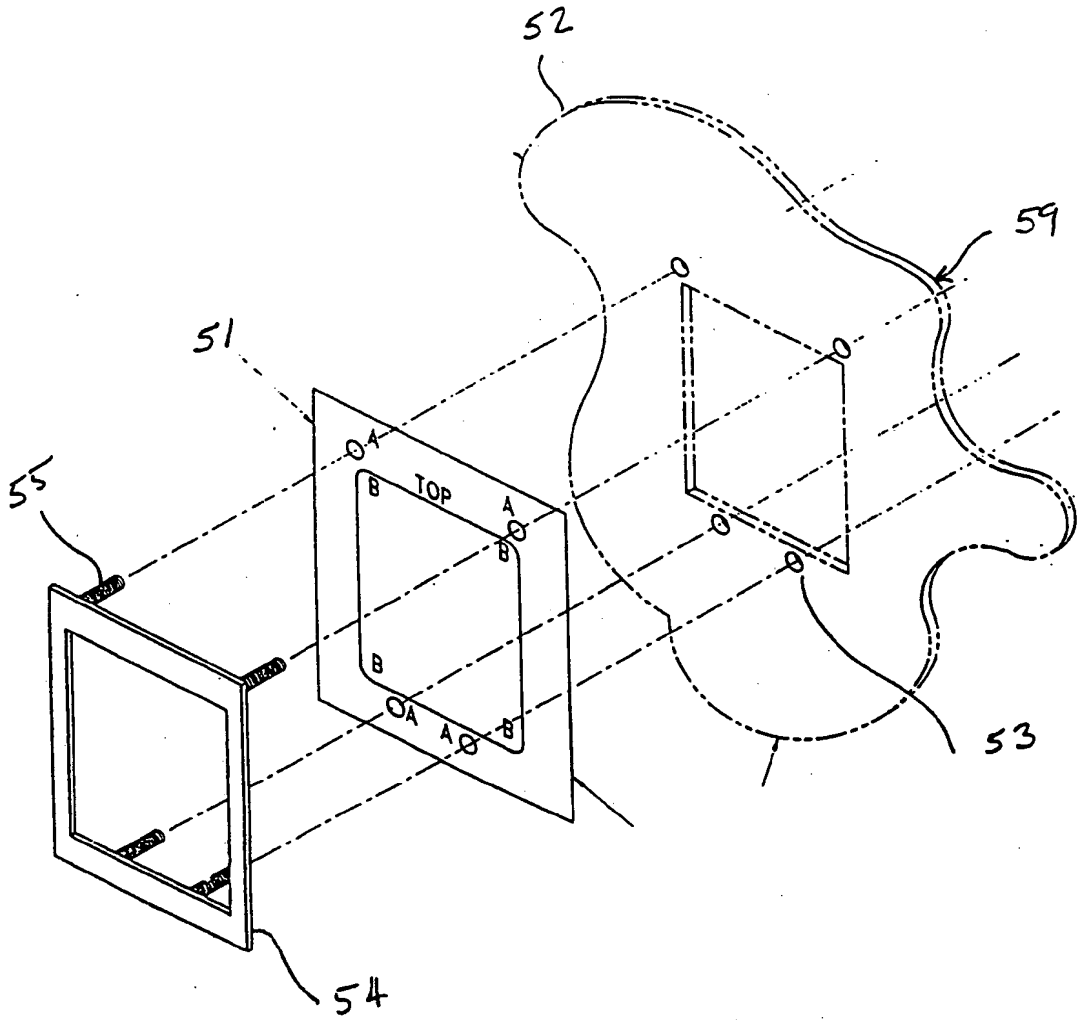

DATA CARD SCANNER
36
DATA CARD SCANNER INTERFACE
39
34
38
PRODUCT SELECTION
DISPENSING CONTROLLER
37
PRODUCT DISPENSING APPARATUS

FIG 7

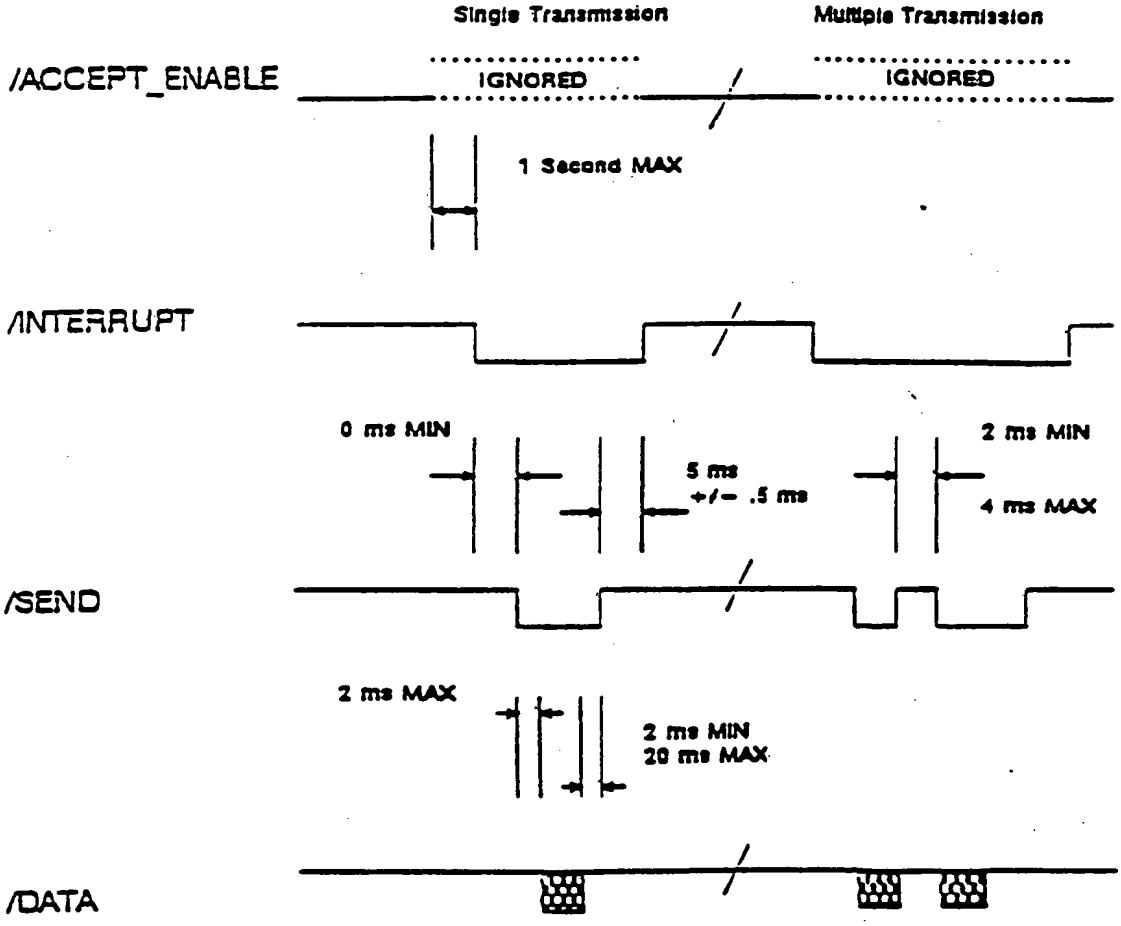


[Prior Art]

FIG 8

TIMING DIAGRAMS

Single / Multiple handshaking message transmission



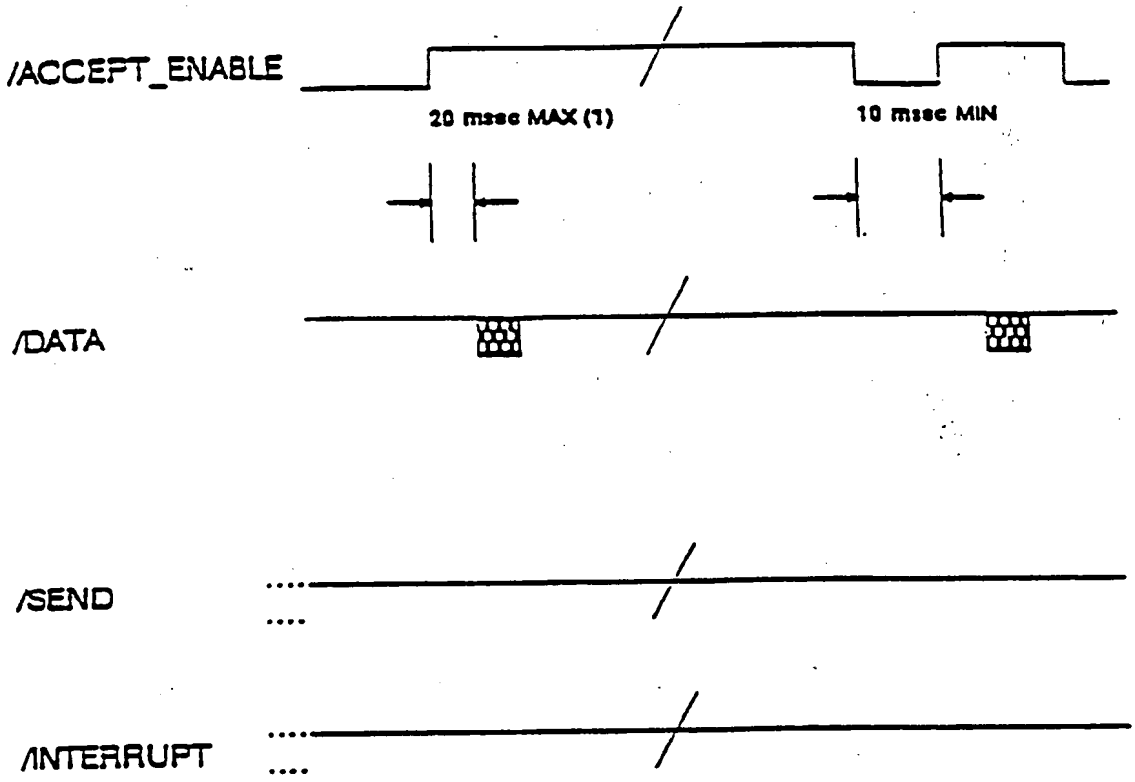
NOTE: Data sent as : START D0 D1 D2 D3 D4 D5 D6 D7 STOP

[Prior Art]

FIG 9

TIMING DIAGRAMS

Tube Status Message Request



[Prior Art]

FIG 10

(MSB) D7	D6	D5	D4	D3	D2	D1	(LSB) D0
0	CVH	CVL	/MT05	/MT10	/MT25	C	I

where

I = Routing information
- 0 = Cash Box
- 1 = Inventory tube

C = Message Class
- 0 = Coin message
- 1 = Non-Coin message

/MT?? = Lower Sensor status
- 0 = Empty
- 1 = Not Empty

CV? = Value of the coin

CVH CVL

1 1 = 05 cents (nickel)

1 0 = 10 cents (dime)

0 1 = 25 cents (quarter)

0 0 = 100 cents (dollar)

[Prior Art]

FIG 11

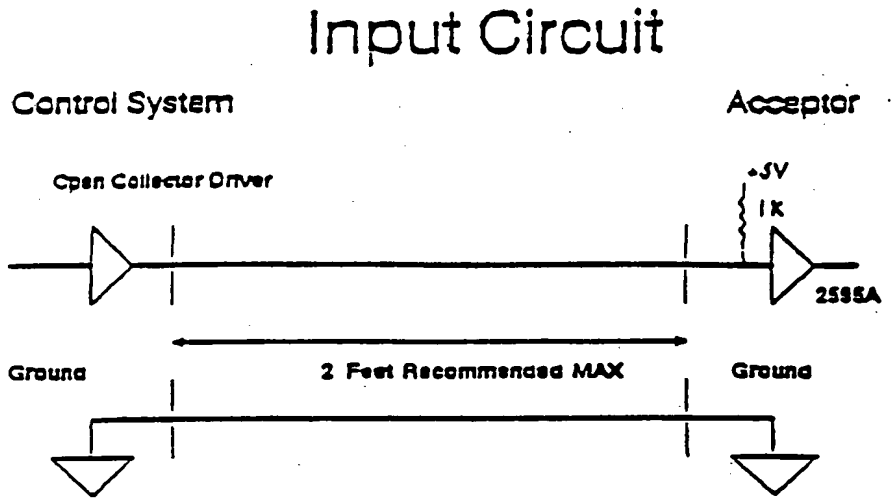
(MSB)							(LSB)
D7	D6	D5	D4	D3	D2	D1	D0
0	0	1	/MT05	/MT10	/MT25	1	I··

where

/MT77 = Lower Sensor status 0 = Empty
1 = Not Empty

[Prior Art]

FIG 12

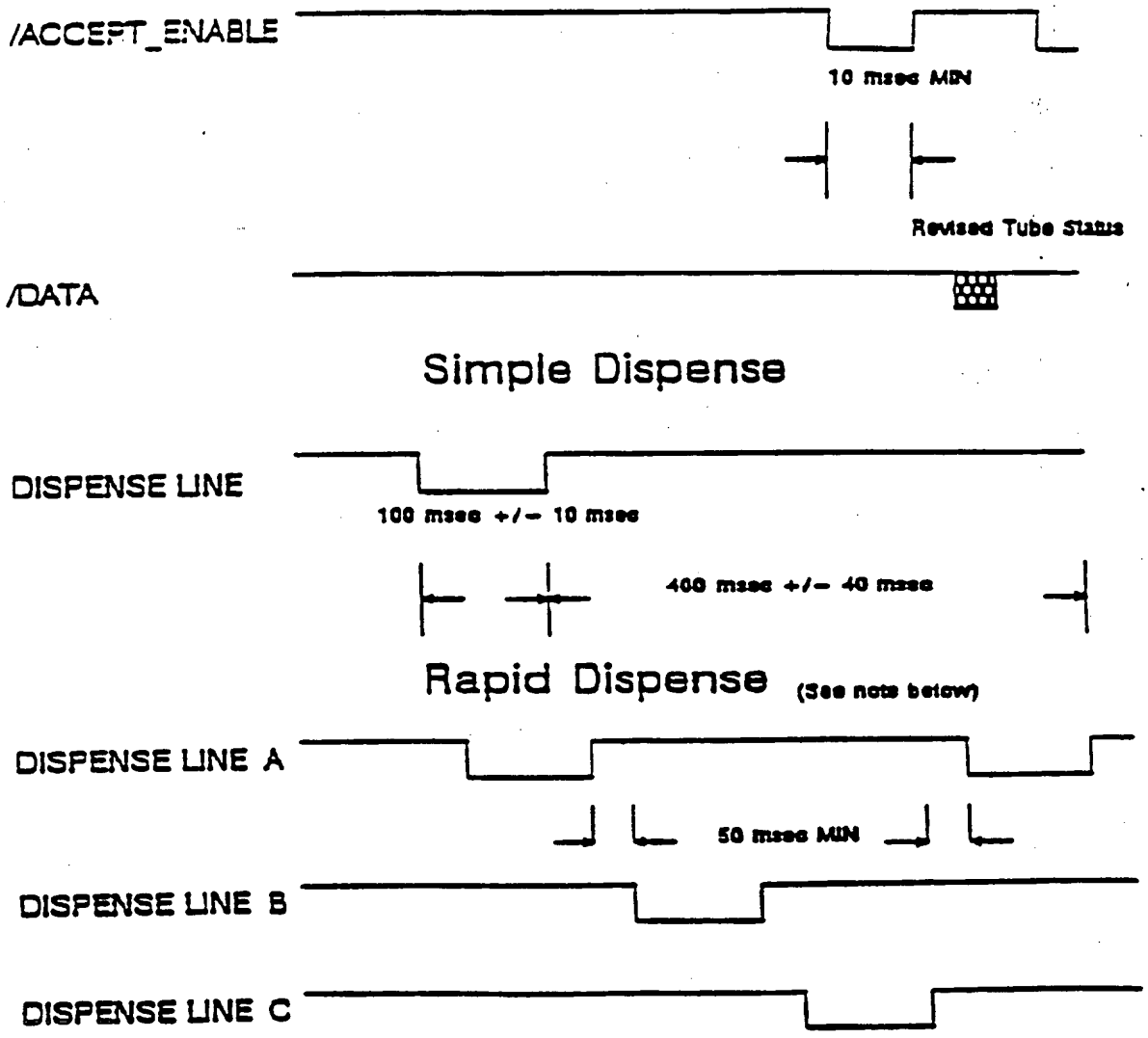


[Prior Art]

FIG 13

TIMING DIAGRAMS

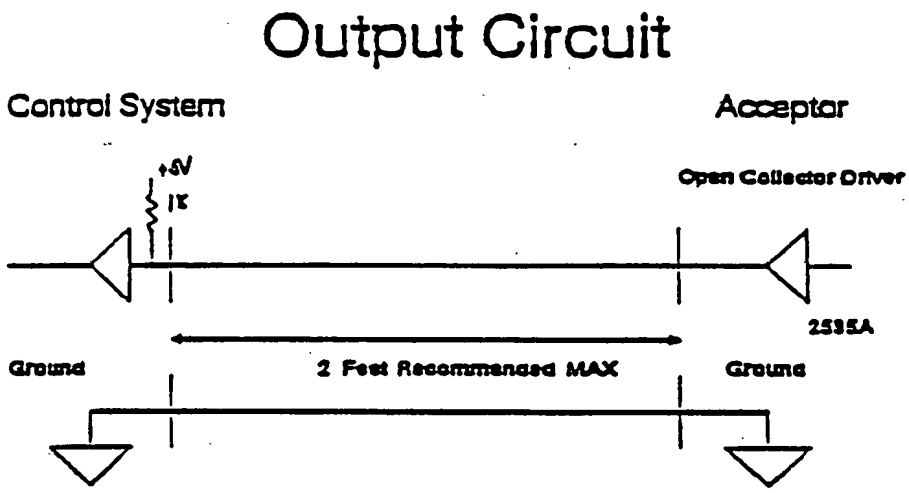
Dispense Timing



NOTE : The On/Off times of 100/400 msec MUST be maintained for each dispenser.

[Prior Art]

FIG 14

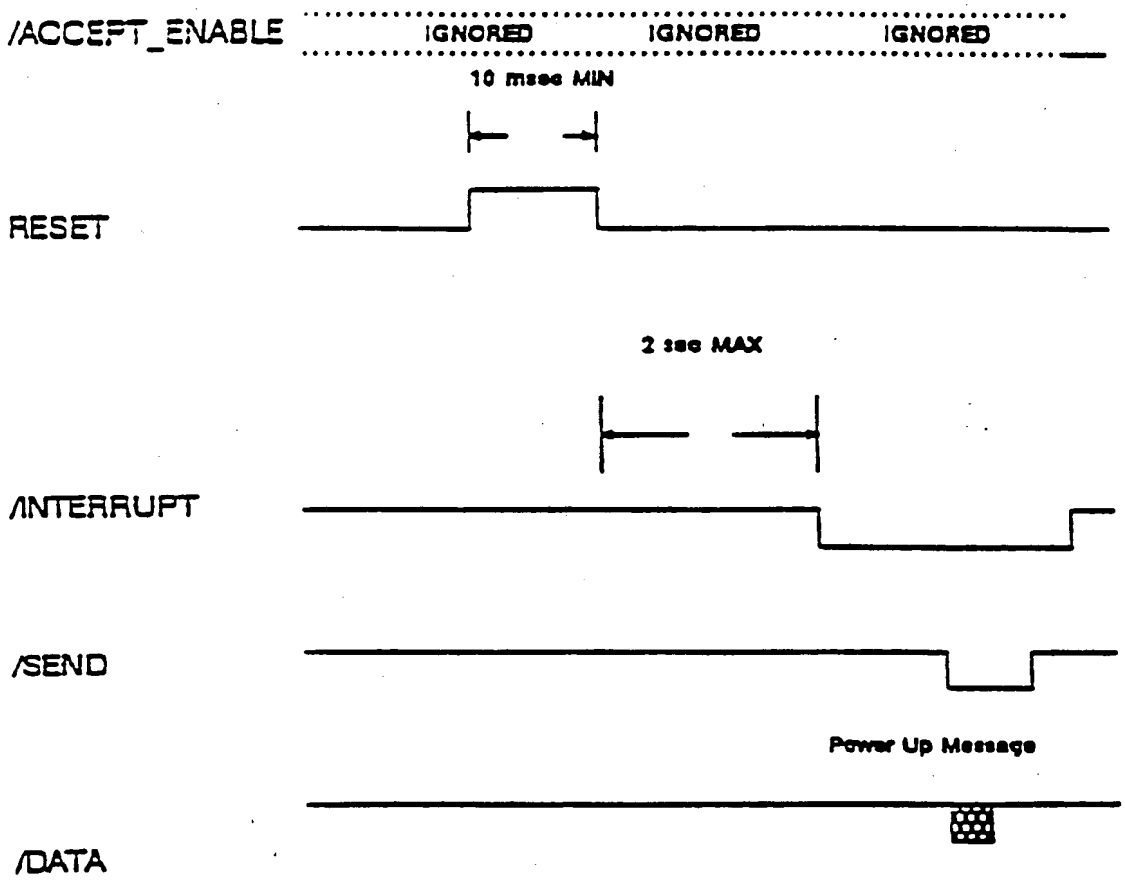


[Prior Art]

FIG 15

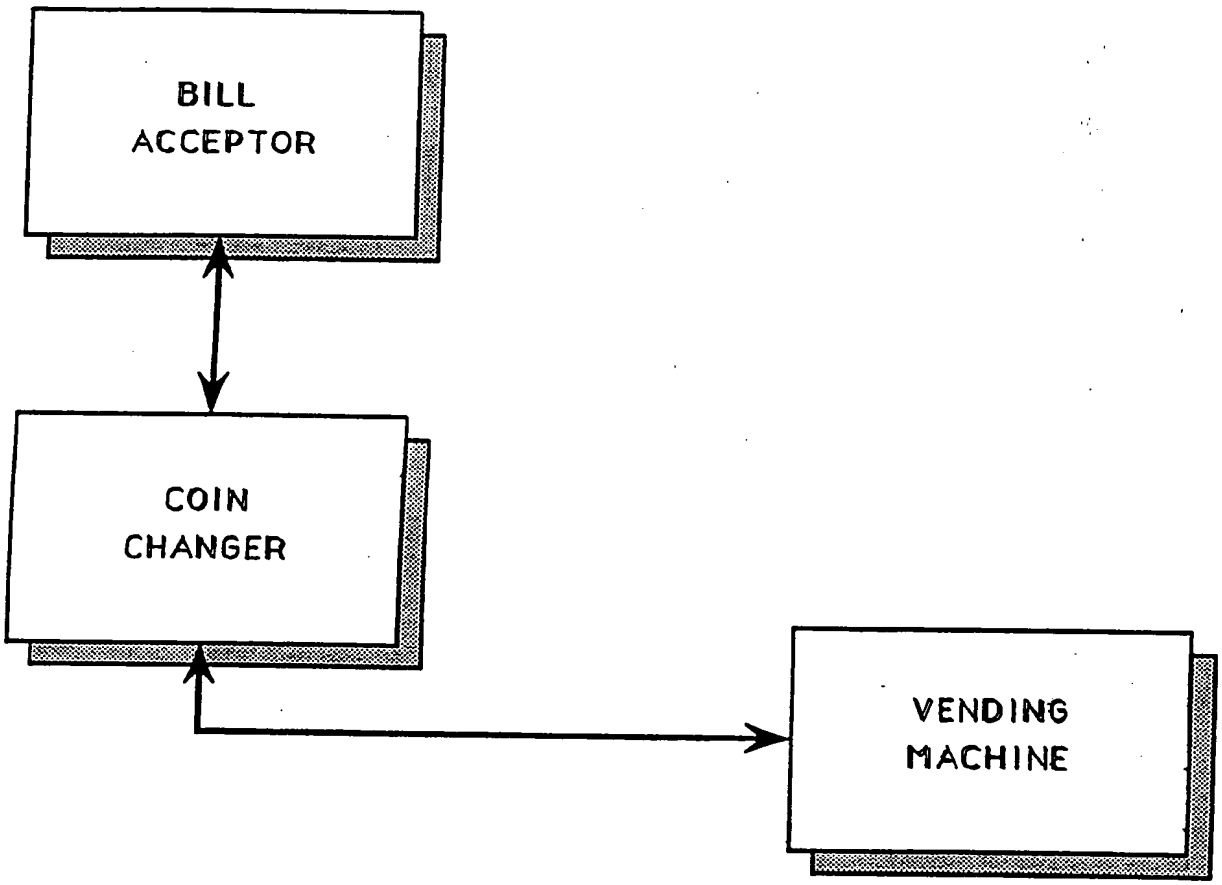
TIMING DIAGRAMS

Power Up / RESET Timing



[Prior Art]

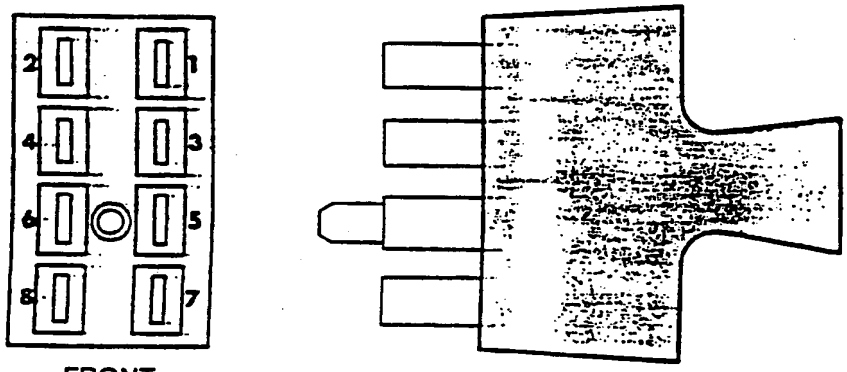
FIG 16



[Prior Art]

FIG 17

COIN MECHANISM PLUG



PIN #	FUNCTION
1	117/24 VAC (hot)
2	117/24 VAC (neutral)
3	Vend Relay—Normally Open (Price #1) (hot)
4	NC
5	Exact Change—Normally Open (neutral)
6	Blocker (hot)
7	Vend Relay—Normally Closed (hot)
8	Escrow To Select Option

[Prior Art]

FIG 18

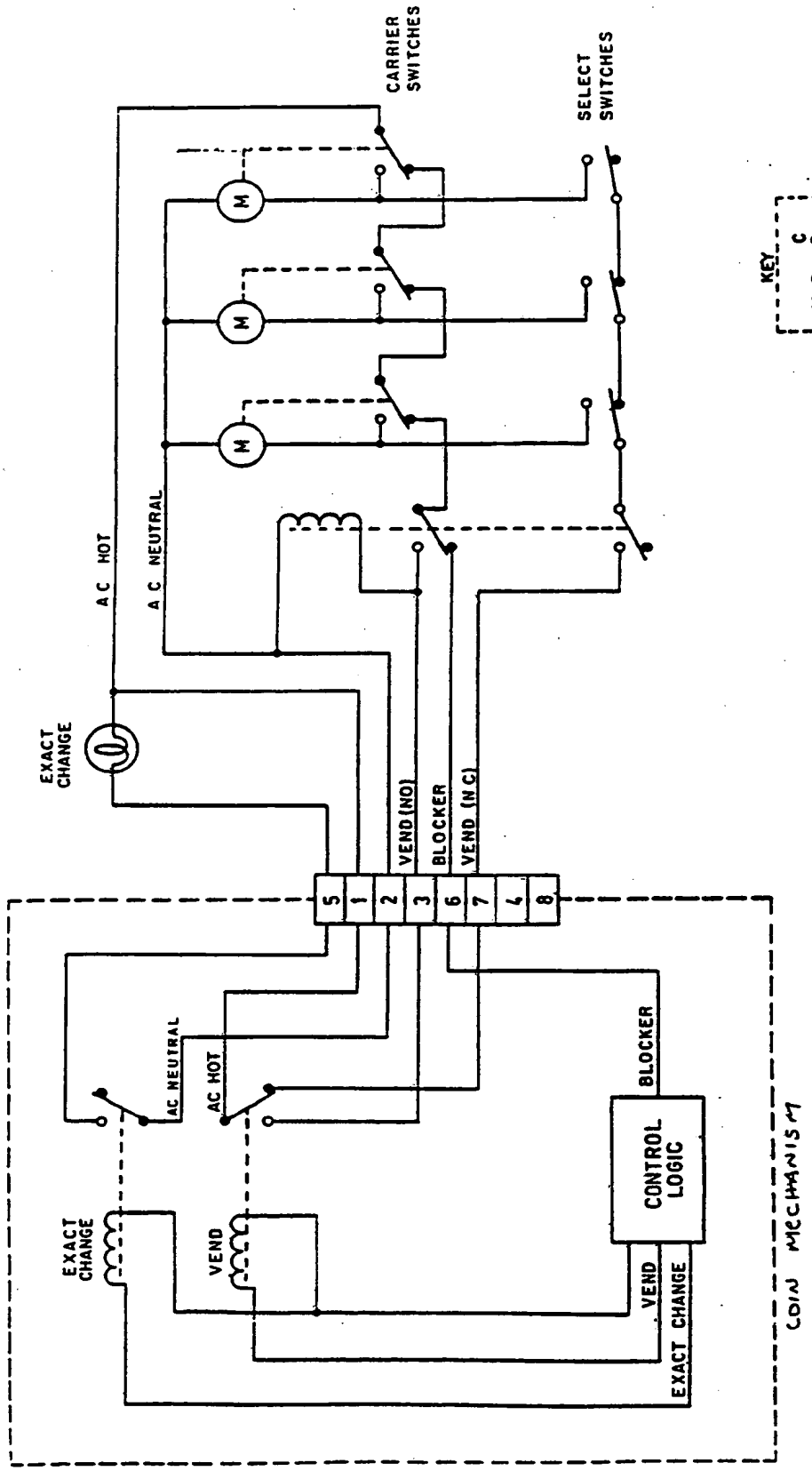
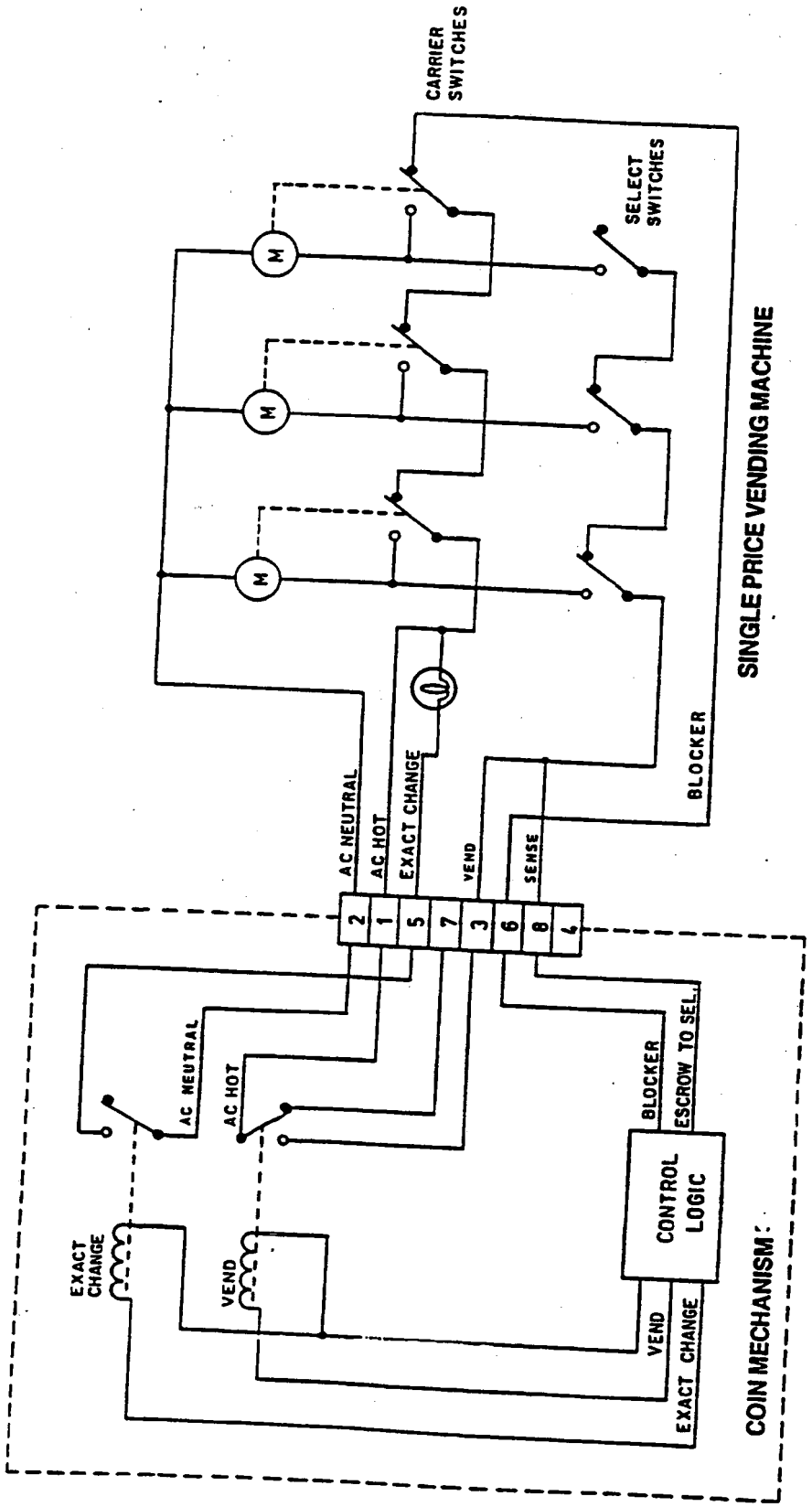


FIG 19

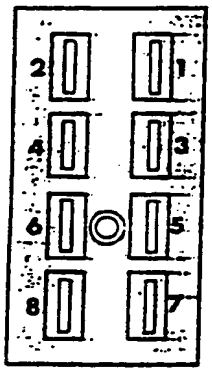
[Prior Art]



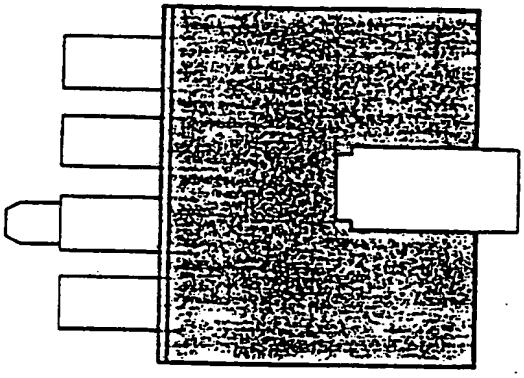
[Prior Art]

FIG 20

COIN MECHANISM PLUG



SIDE

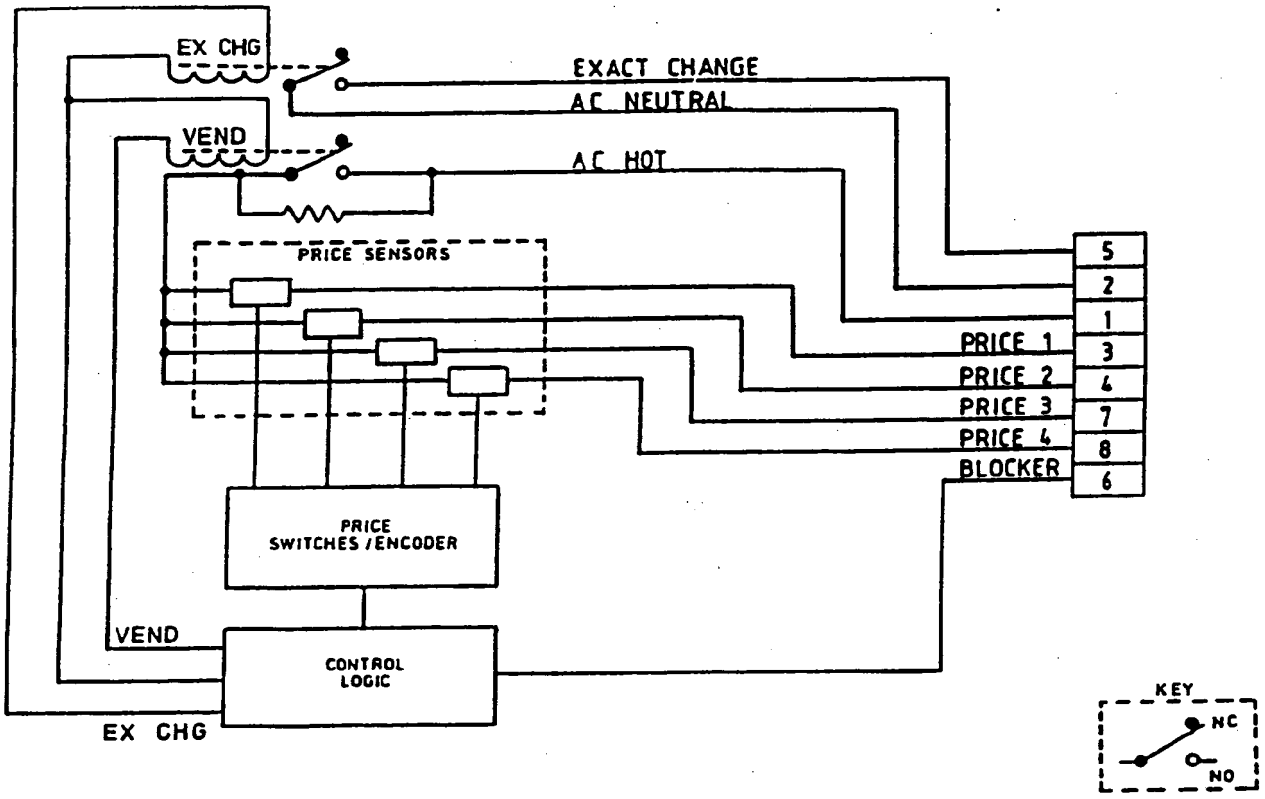


FRONT

PIN #	FUNCTION
1	117/24 VAC (hot)
2	117/24 VAC (neutral)
3	Price #1 (hot)
4	Price #2 (hot)
5	Exact change (neutral)
6	Blocker (hot)
7	Price #3 (hot)
8	Price #4 (hot)

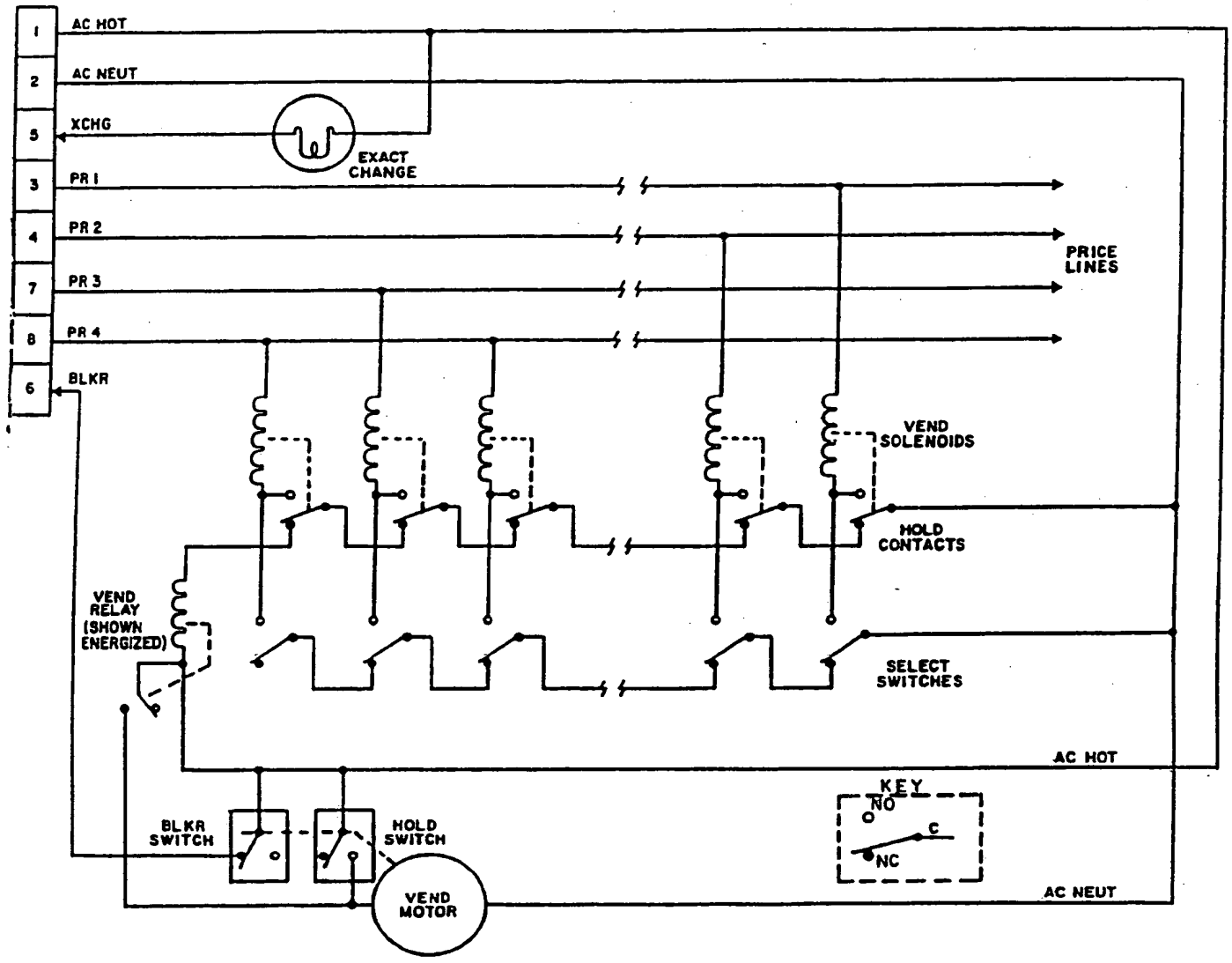
[Prior Art]

FIG 21



[Prior Art]

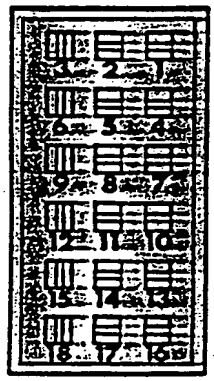
FIG 22



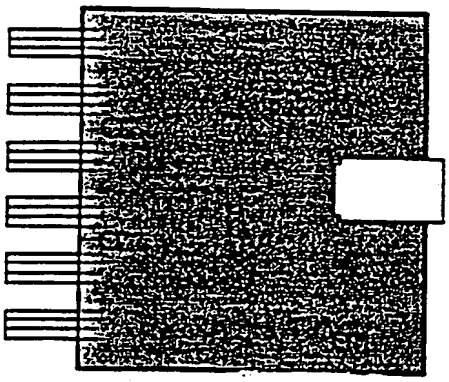
[Prior Art]

FIG 23

COIN MECHANISM PLUG



FRONT

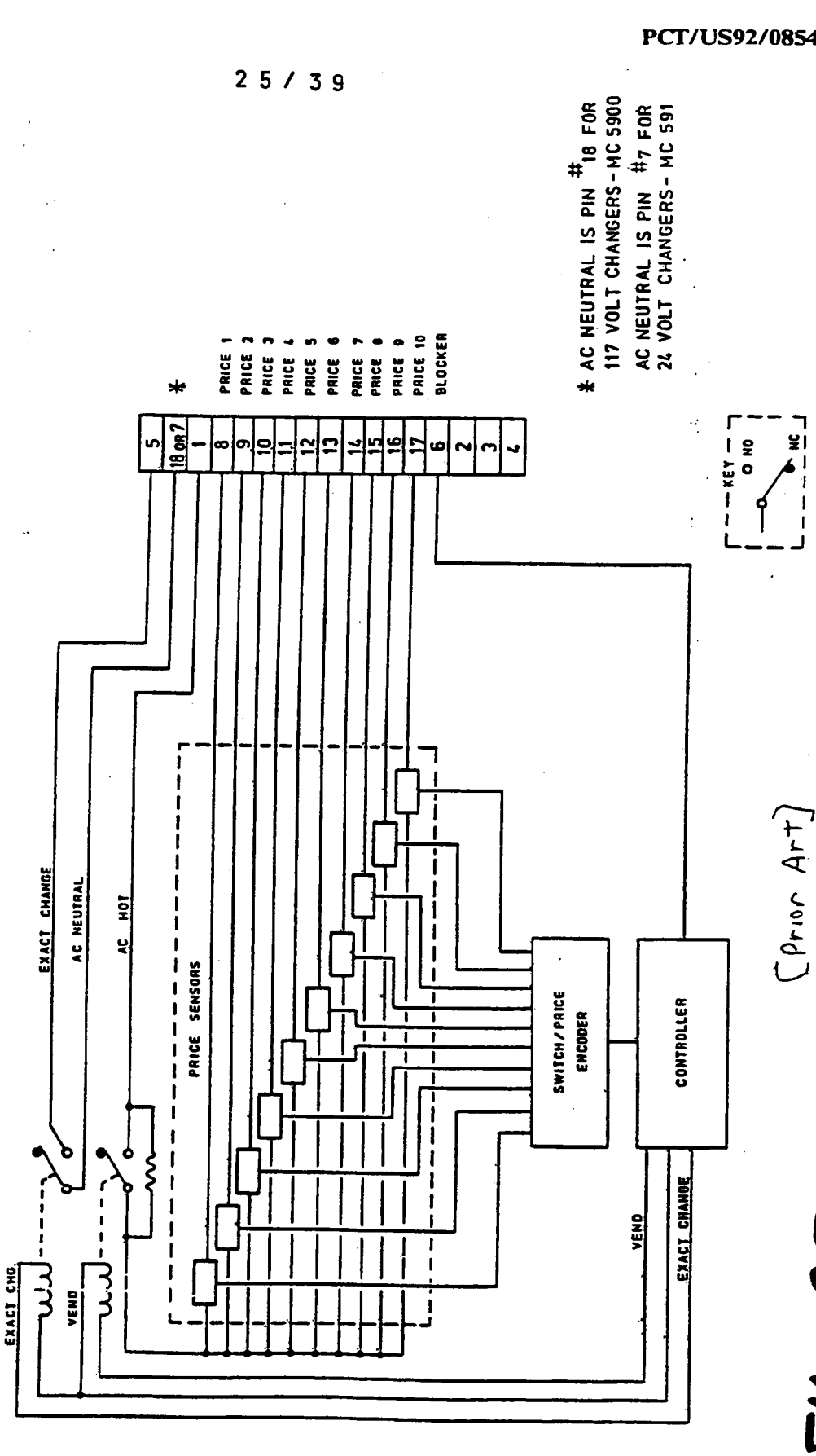


SIDE

PIN #	FUNCTION	
	117 VAC	24 VAC
1	117 VAC (hot)	24 VAC (hot)
2	NC	NC
3	NC	NC
4	NC	NC
5	Exact Change (neutral)	Exact Change (neutral)
6	Blocker (hot)	Blocker (hot)
7	NC	24 VAC (neutral)
8	Price #1 (hot)	Price #1 (hot)
9	Price #2 (hot)	Price #2 (hot)
10	Price #3 (hot)	Price #3 (hot)
11	Price #4 (hot)	Price #4 (hot)
12	Price #5 (hot)	Price #5 (hot)
13	Price #6 (hot)	Price #6 (hot)
14	Price #7 (hot)	Price #7 (hot)
15	Price #8 (hot)	Price #8 (hot)
16	Price #9 (hot)	Price #9 (hot)
17	Price #10 (hot)	Price #10 (hot)
18	117 VAC (neutral)	NC

[Prior Art]

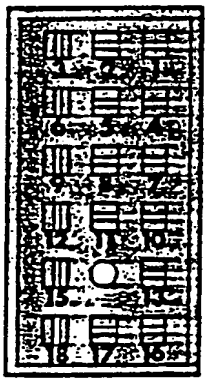
FIG 24



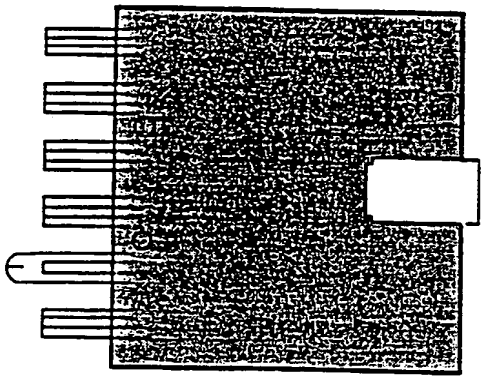
(Prior Art)

FIG 25

COIN MECHANISM PLUG



FRONT

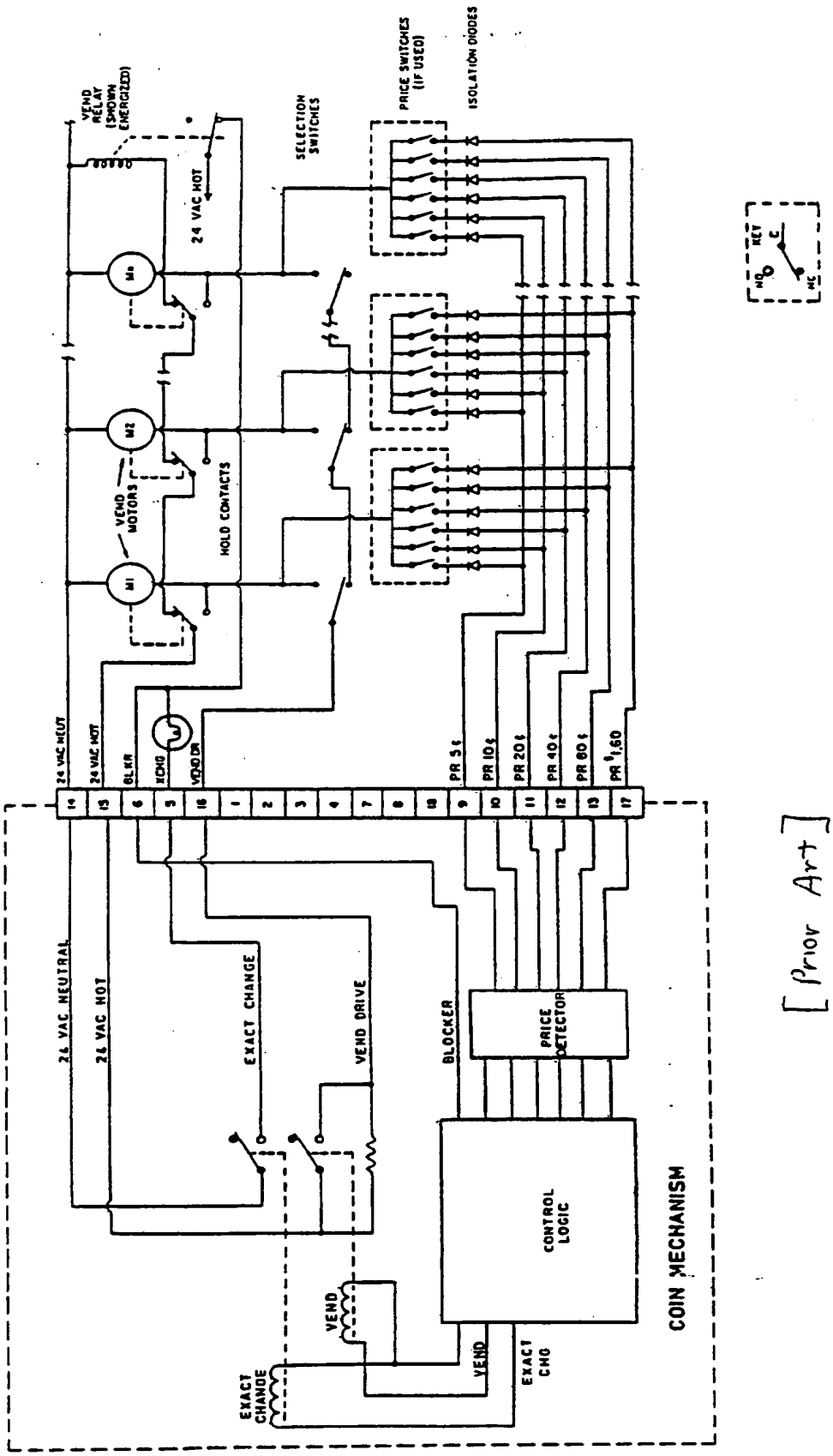


SIDE

PIN #	FUNCTION
1	NC
2	NC
3	NC
4	NC
5	Exact Change (neutral)
6	Blocker (hot)
7	NC
8	NC
9	Price line #1 (hot) $.05
10	Price line #2 (hot) $.10
11	Price line #4 (hot) $.20
12	Price line #8 (hot) $.40
13	Price line #16 (hot) $.80
14	24 VAC (neutral)
15	24 VAC (hot)
16	Vend drive (hot)
17	Price #32 (hot) $1.60
18	NC

[Prior Art]

FIG 26



[Prior Art]

FIG 27

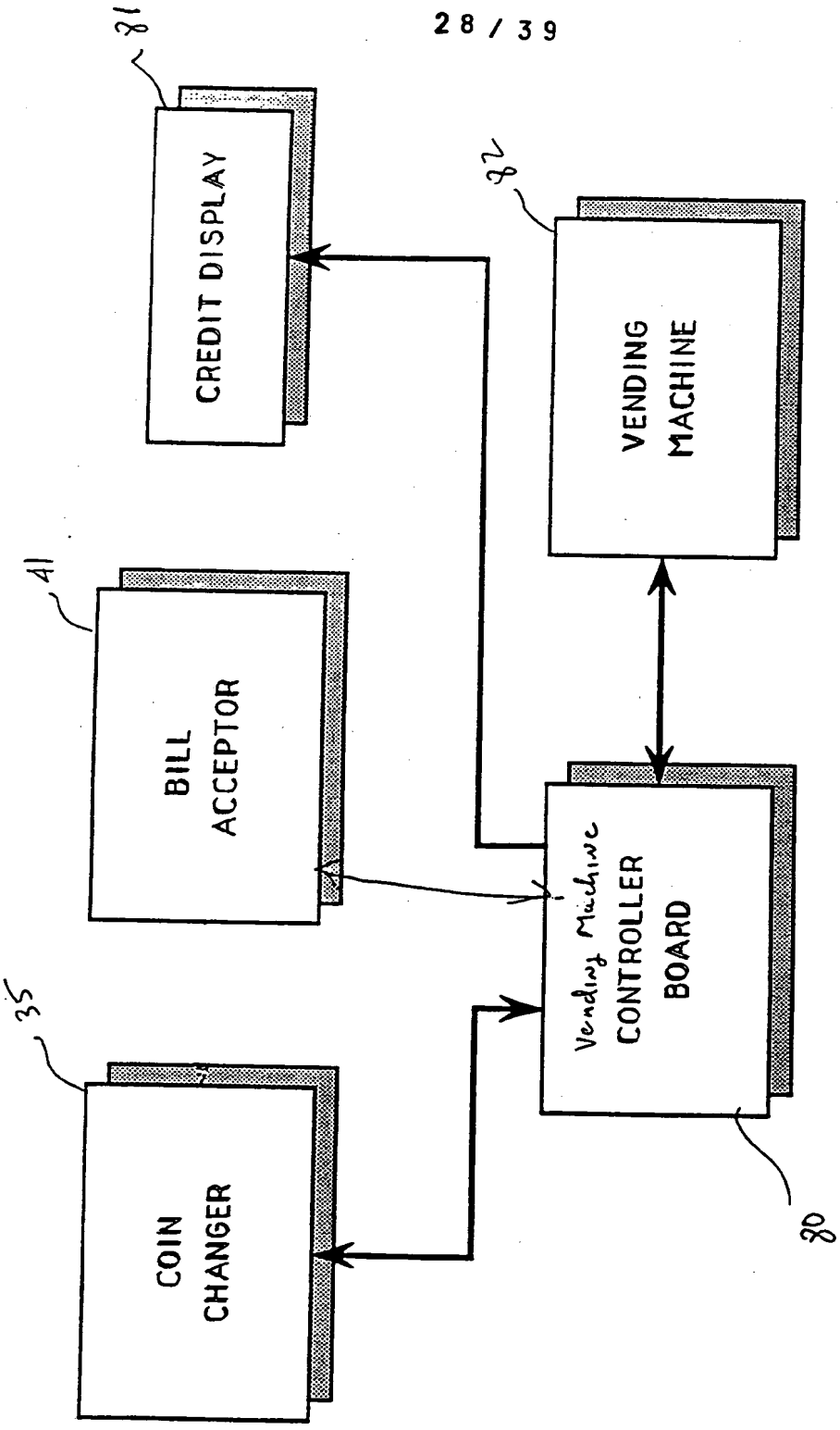
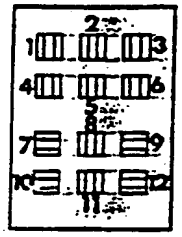


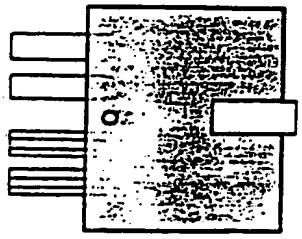
FIG 28

[Prior Art]

COIN MECHANISM PLUG



FRONT



SIDE

PIN #	FUNCTION
1	5 VDC supply positive
2	5 VDC supply return
3	Send (0-Volts active)
4	Interrupt (0-Volts active)
5	Data (0-Volts active)
6	Accept Enable (0-Volts active)
7	25¢ Dispense (0-Volts active)
8	10¢ Dispense (0-Volts active)
9	5¢ Dispense (0-Volts active)
10	117/24 VDC supply return
11	Reset (+5 VDC active)
12	117/24 VDC supply positive (rectified unfiltered)

[Prior Art]

FIG 29

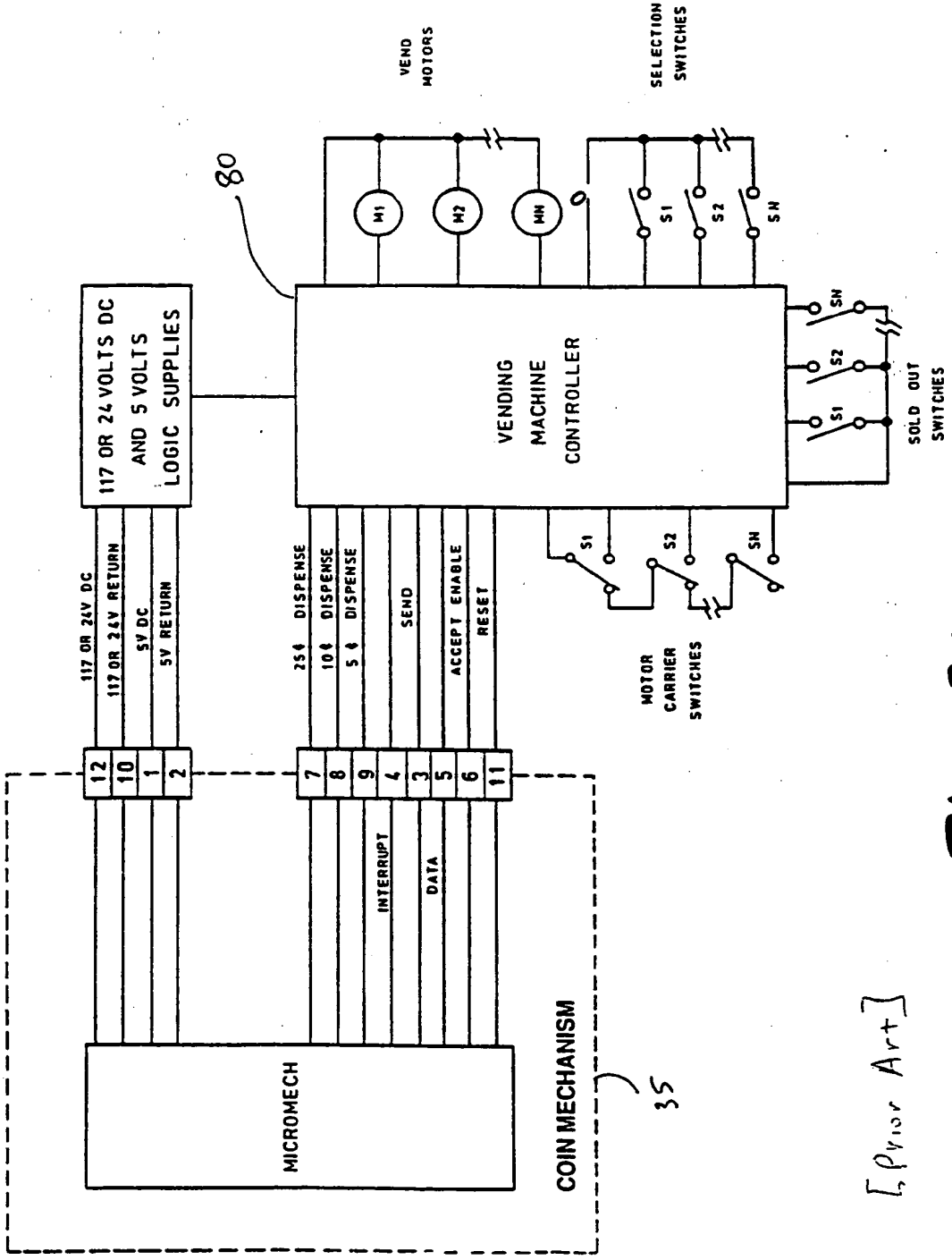


FIG 30

[Prior Art]

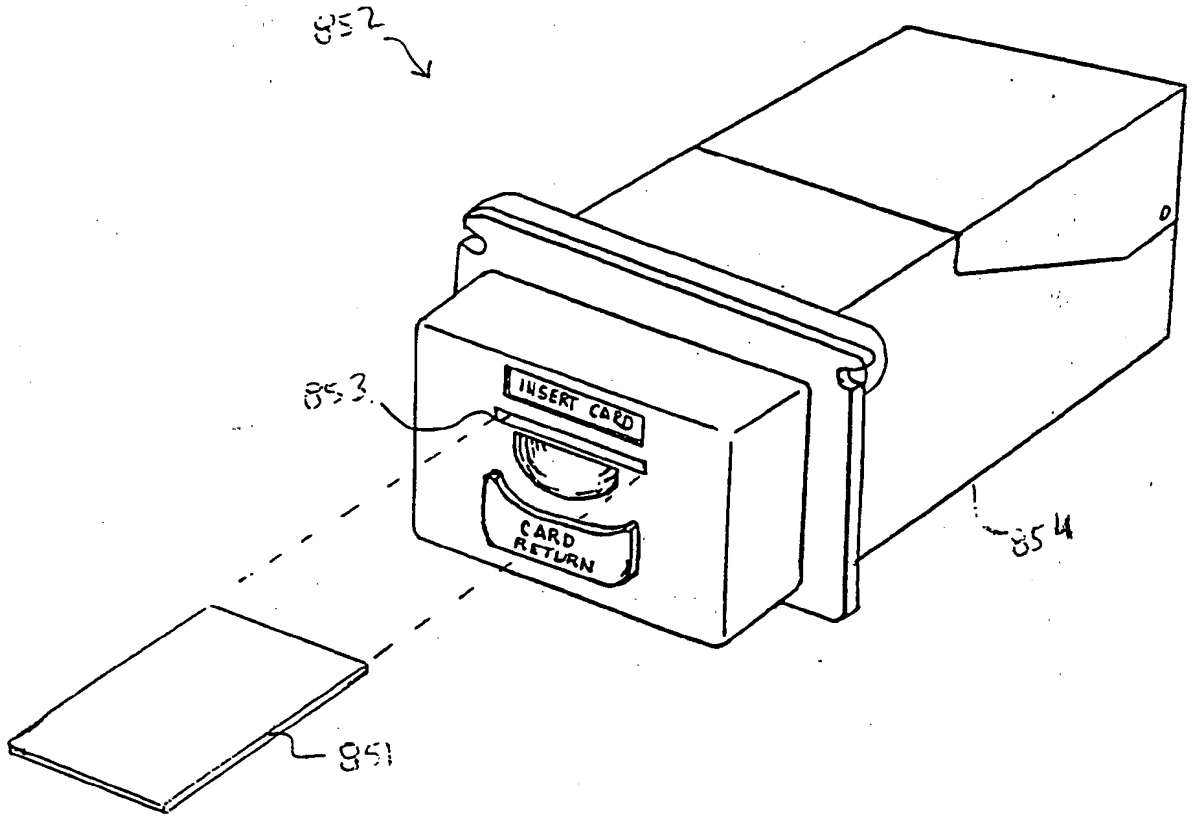


FIG 31

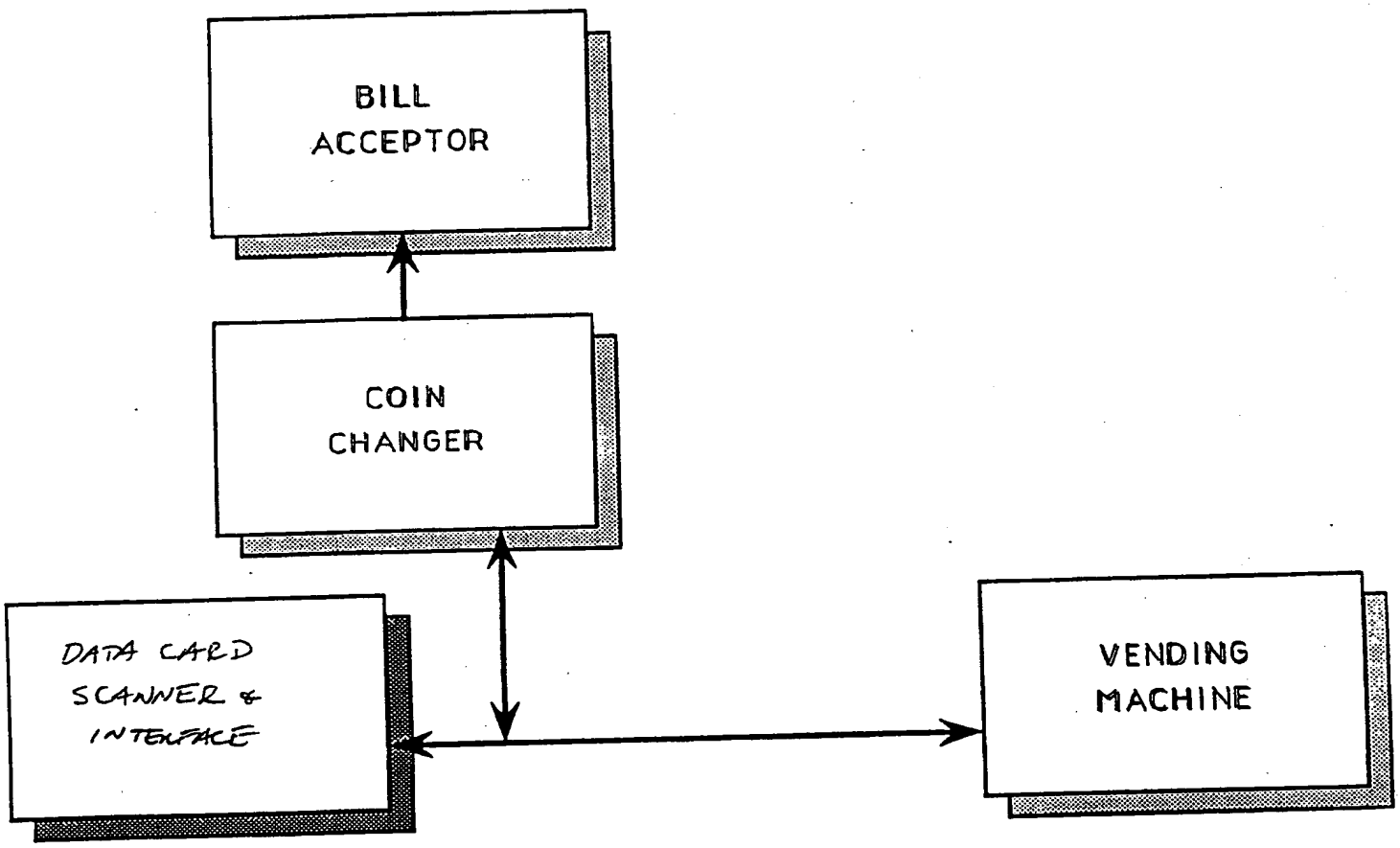

BILL
ACCEPTOR
COIN
CHANGER
DATA CARD
SCANNER &
INTERFACE
VENDING
MACHINE

FIG 32

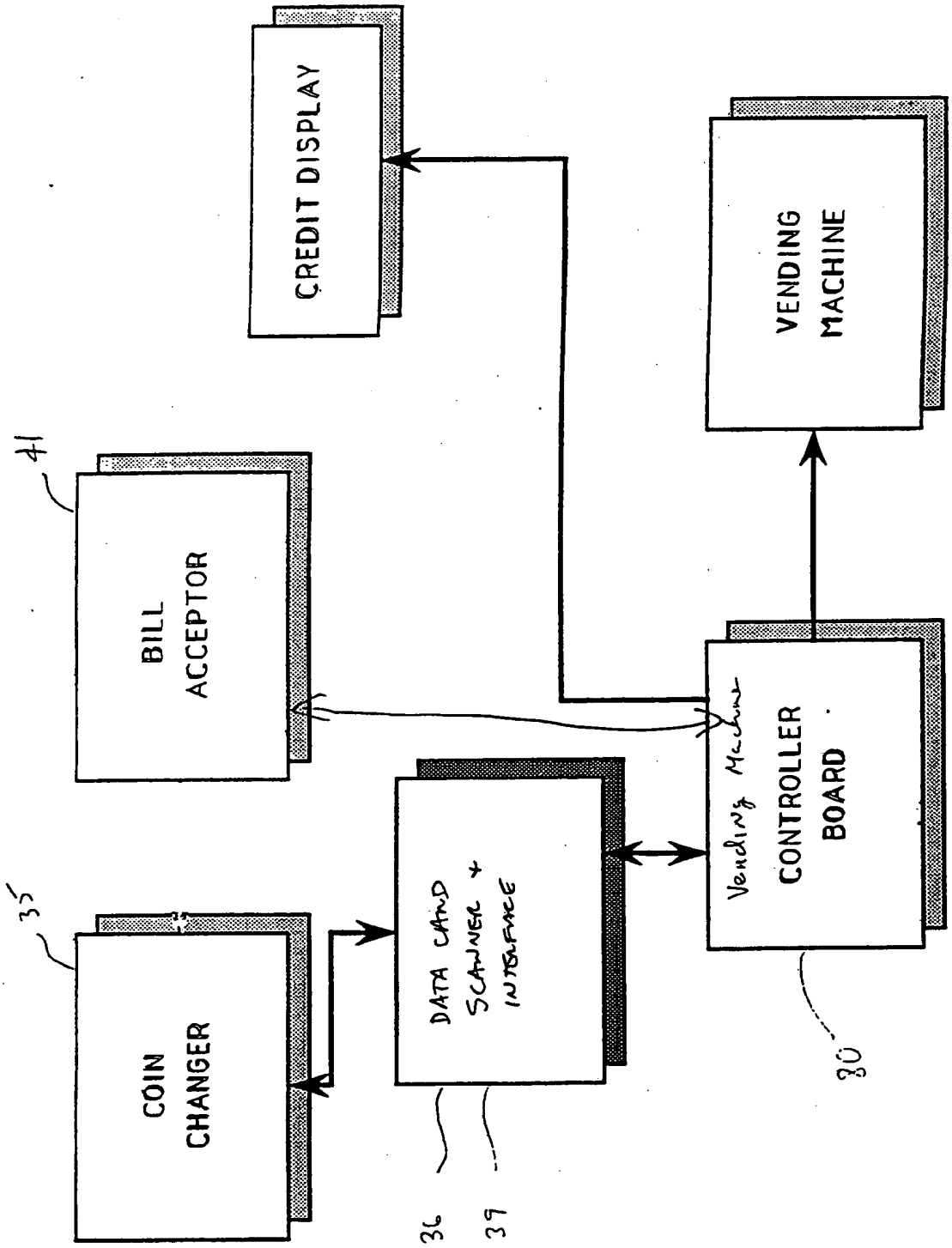

CREDIT DISPLAY
VENDING MACHINE
41
BILL ACCEPTOR
Vending Machine
CONTROLLER BOARD
DATA CARD SCANNER + INTERFACE
COIN CHANGER
35
36
39
30

FIG 33

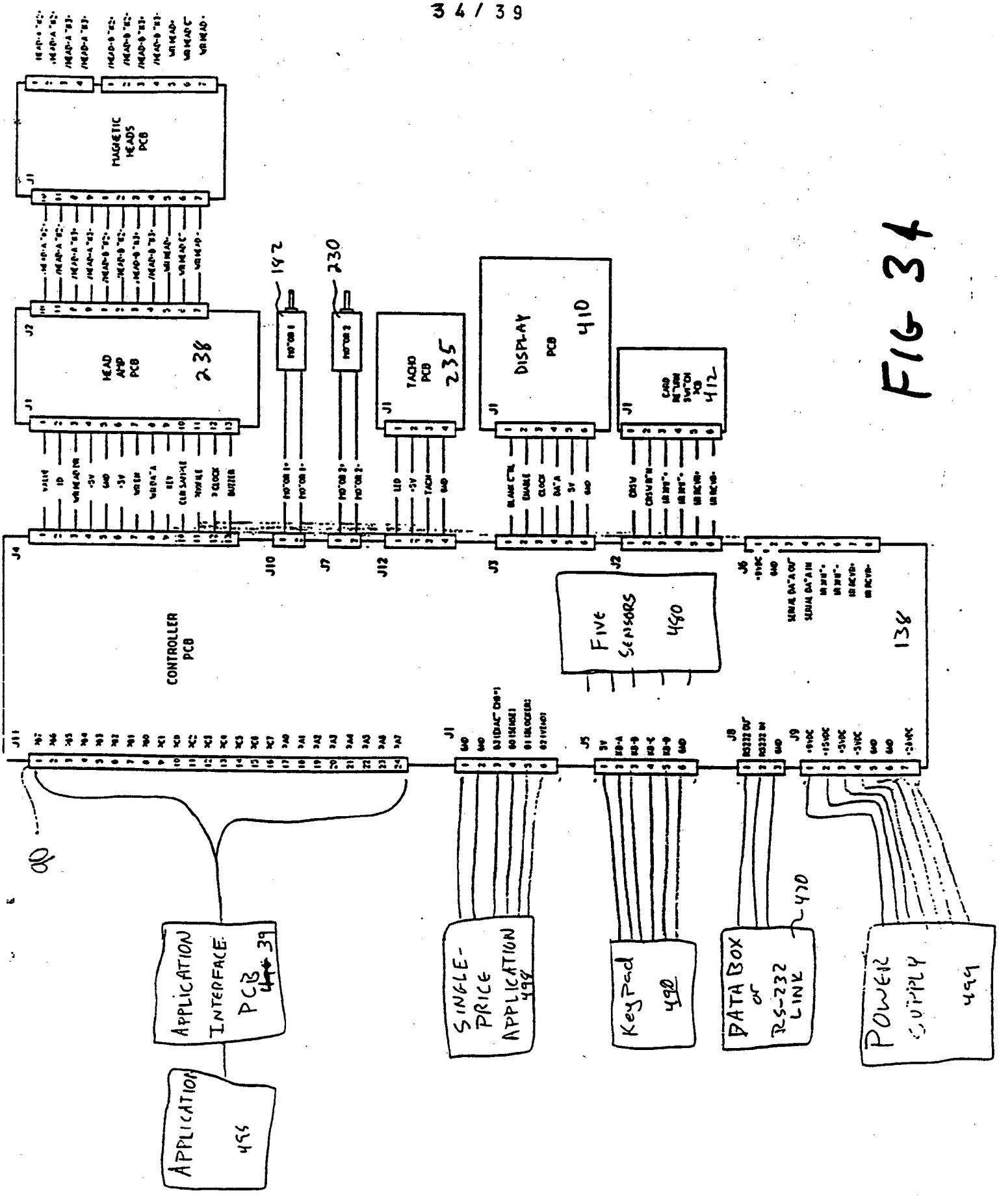
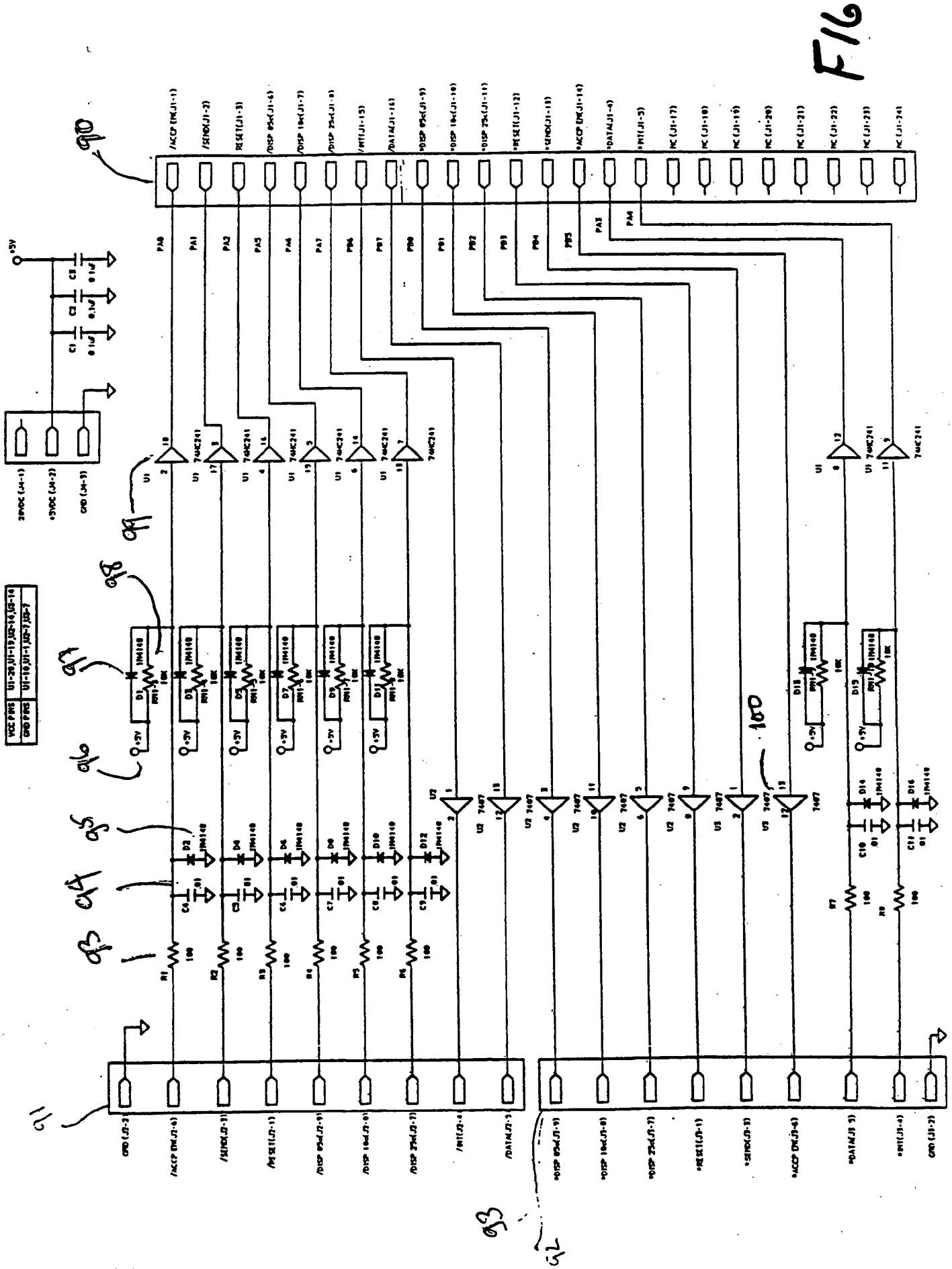

MAGNETIC HEADS PCB
HEAD AMP PCB 238
TACHO PCB 235
DISPLAY PCB 410
CARD RETAIN SWITCH ASSY 412
CONTROLLER PCB
FIVE SENSORS 490
APPLICATION INTERFACE PCB 39
APPLICATION 494
SINGLE-PRICE APPLICATION 498
KEYPAD 490
DATA BOX OR RS-232 LINK 420
POWER SUPPLY 499
138

FIG 34

FIG



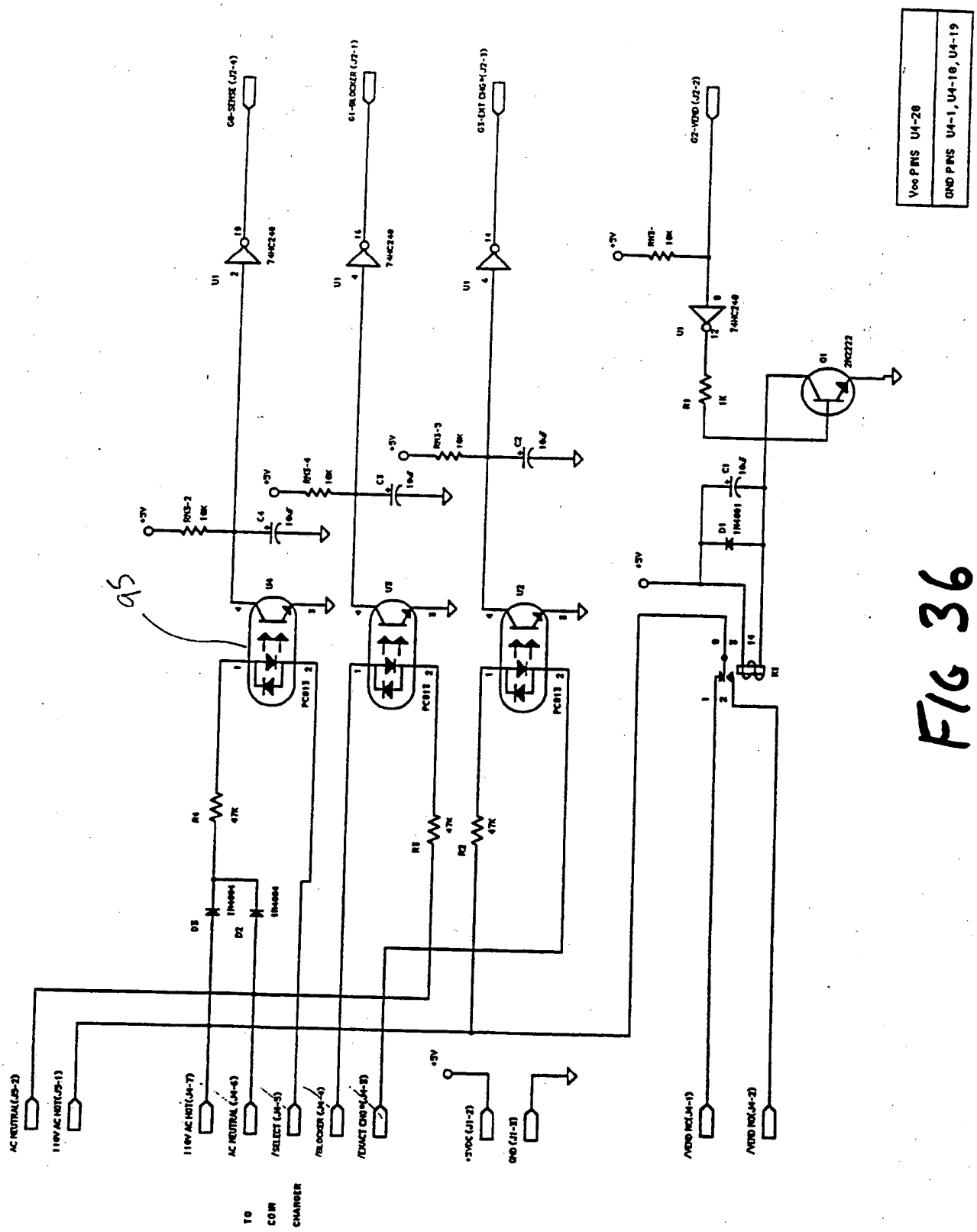

Vcc PINS U4-20
GND PINS U4-1, U4-18, U4-19
74HC240
PC817
2N2222
1N4001
1N4004
+5V
AC NEUTRAL (J5-2)
110V AC HOT (J5-1)
110V AC HOT (J4-7)
AC NEUTRAL (J4-6)
/SELECT (J4-5)
/BLOCKER (J4-4)
/EXACT CHG (J4-3)
+5VDC (J1-2)
GND (J1-1)
/VEND HOT (J4-1)
/VEND NEU (J4-2)
TO COIN CHANGER

FIG 36

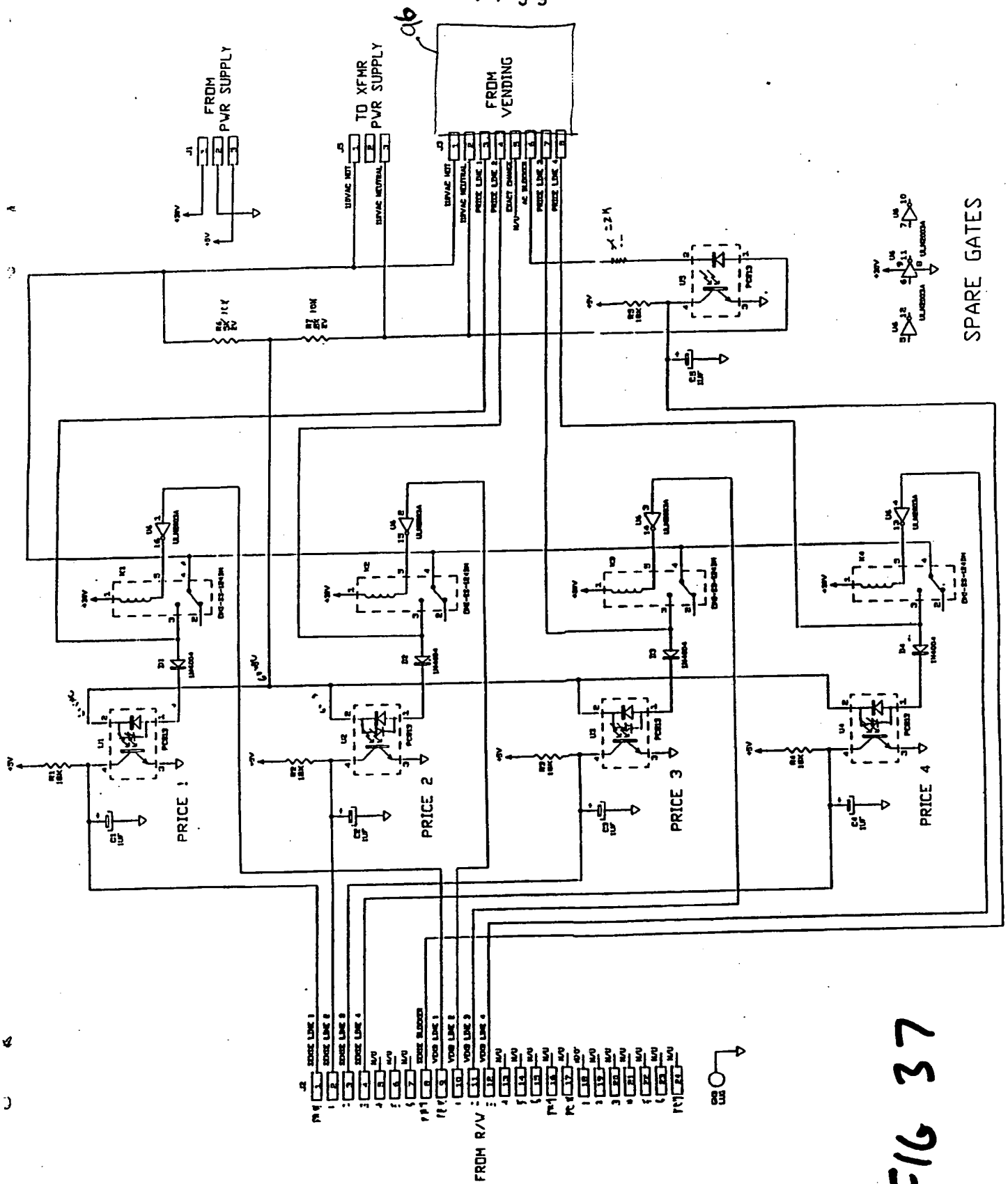

FROM PWR SUPPLY
TO XFMR PWR SUPPLY
FROM VENDING
SPARE GATES
PRICE 1
PRICE 2
PRICE 3
PRICE 4
FROM R/V

FIG 37

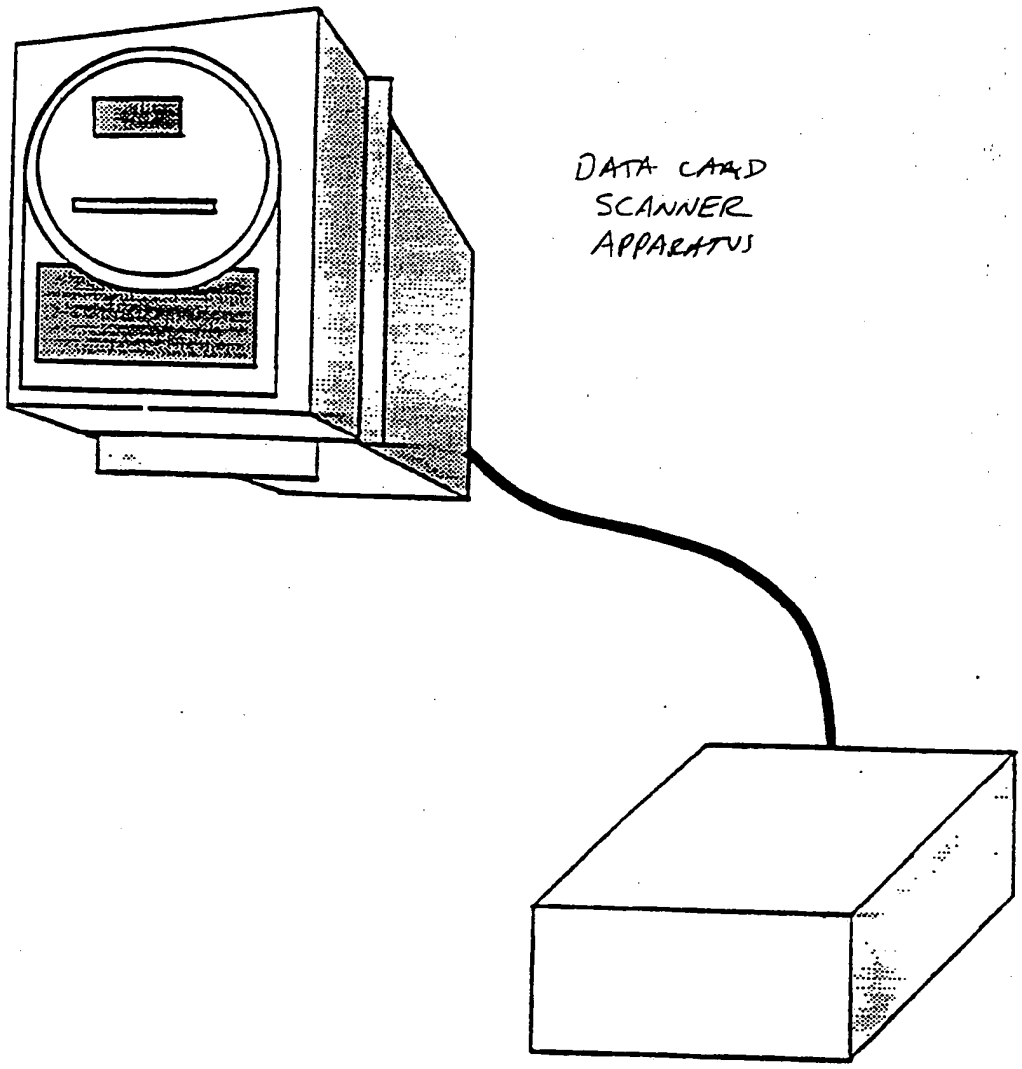


FIG 38

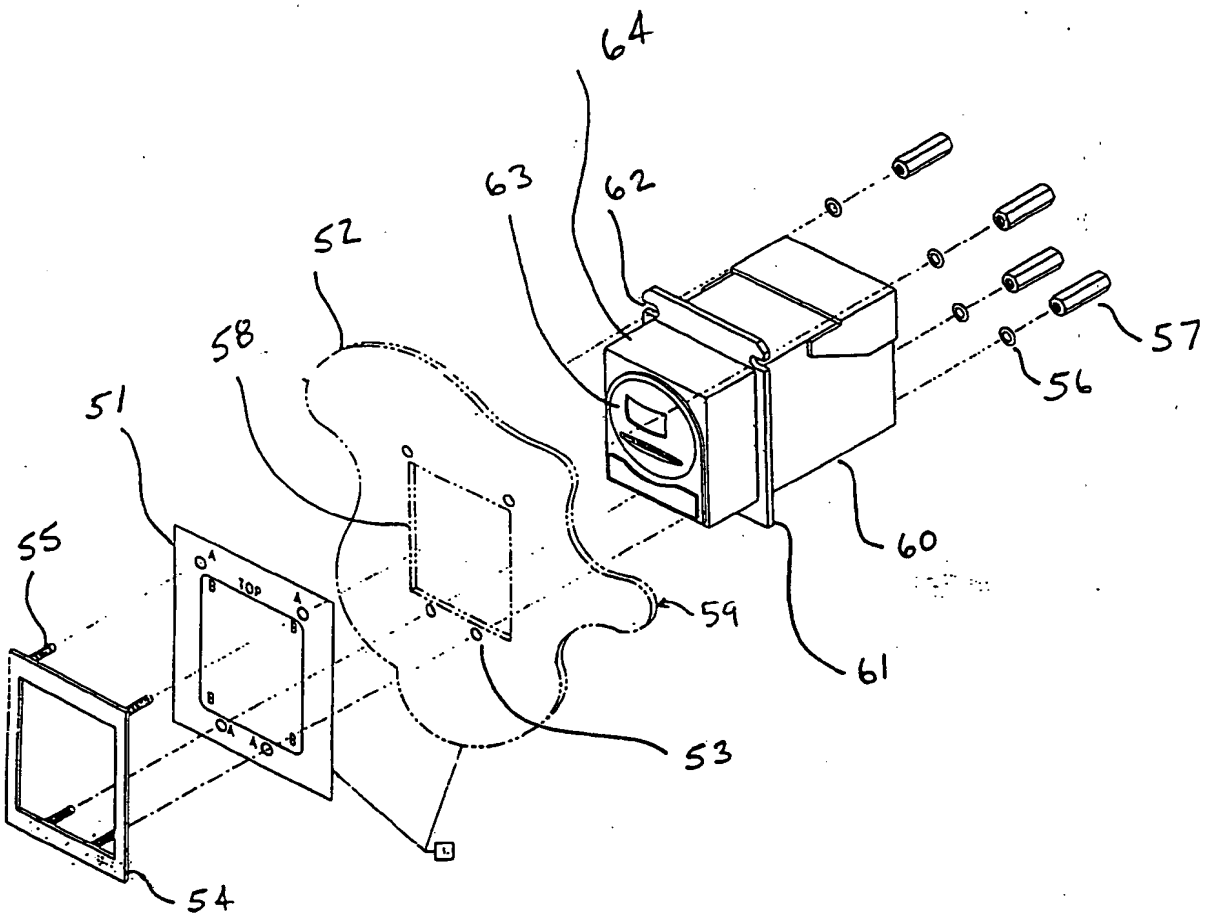


FIG 39

INTERNATIONAL SEARCH REPORT

International Application No.
PCT/US92/08543

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :G07F 7/08
US CL :194/206
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 194/206, 207, 208, 209, 210, 217, 218; 235/381, 383

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US, A, 4,669,596 (CAPERS ET AL.) 02 June 1987, see col. 3, lines 4-9 and col. 4, lines 10-31.	1-4, 8, 9, 13, 14, 18, 22 5-7, 10-12, 15-17, 19-21, 23-25
Y	US, A, 3,786,421 (WOSTL ET AL.) 15 January 1974, see col. 1, line 60 to col. 2, line 30 and col. 9, lines 37-51.	5, 10, 15, 19, 23
Y	US, A, 3,362,515 (YAMAMOTO ET. AL.) 09 January 1968, see col. 5, lines 6-35.	6, 7, 11, 12, 16, 17, 30, 21, 24, 25

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

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"A" document defining the general state of the art which is not considered to be part of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 NOVEMBER 1992	21DEC 1992
Name and mailing address of the ISA/ Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. NOT APPLICABLE	Authorized officer F. J. BARTUSKA Telephone No. (703) 308-1113

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US92/08543

C (Continuation): DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US, A, 4,954,697 (KOKUBUN ET AL.) 04 September 1990	